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Diffrential Upliftment of S Central Kaladgi Basin, It's Impact on the Quartzarenites Exposed in the Visinity of Saundatti and Sirasangi, Balgaum District, Karnataka.

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ABSTRACT:- The Quartzarenites exposed in the vicinity of Saundatti and Sirasangi, Balgaum district, Karnataka state formulate the S central margin of main Kaladgi basin. These are resting uncomfortably over the Achaean gneisses of Dharwar Super- Group with a profound unconformity, marked by an angular relationship between two Formations and conglomeratic horizons. The Quartzarenites have a general trend of E-W, dipping northward gently and as high as 35° dip with N70°E- S70°W strike,at some deformed places. These rocks bear a signature of differential uplitfment of the basin itself evidenced by several differential lateral movements in the form of strike fault, diagonal slip faults and many other rupture structures. The detailed geological investigations carried out unravel multiferious structural features which are depicted in the form of maps, photographs and description in the preceding paragraphs.

Keywords:- Quartzarenites, Kaladgi Basin, Upliftment, Shear, Fault, pseudotachylytes.

I. INTRODUCTION

The study area contained in the Survey of India toposheet no. 48M/1 (new no,) and the cardinal co-ordinates of the area studied are 75˚ 06' 36" and 75˚ 15' 00" E longitude, and 15˚ 47' 40" and 15˚ 54' 00" N latitude. The area encompasses Saundatti, Parasgad, Yellammagudda, Huli, Hulikatti, Manikatti, Yekkeri, Manoli, Naveliteertha (Malaprabha dam site), Goravanakolla, Katmalli, Basidoni and Sirasangi etc. The quartzarenitic rocks occur in the form of high ridges occupying hilltops and valley slopes, with dip slope and escarpment scenery, which prompted the researchers to travers the whole area and collect detailed structural information required. The Quartzarenites are resting over Archaean basement of granitic gneisses of DharwarSupergroup

Figure1(a): Satellite image of study area

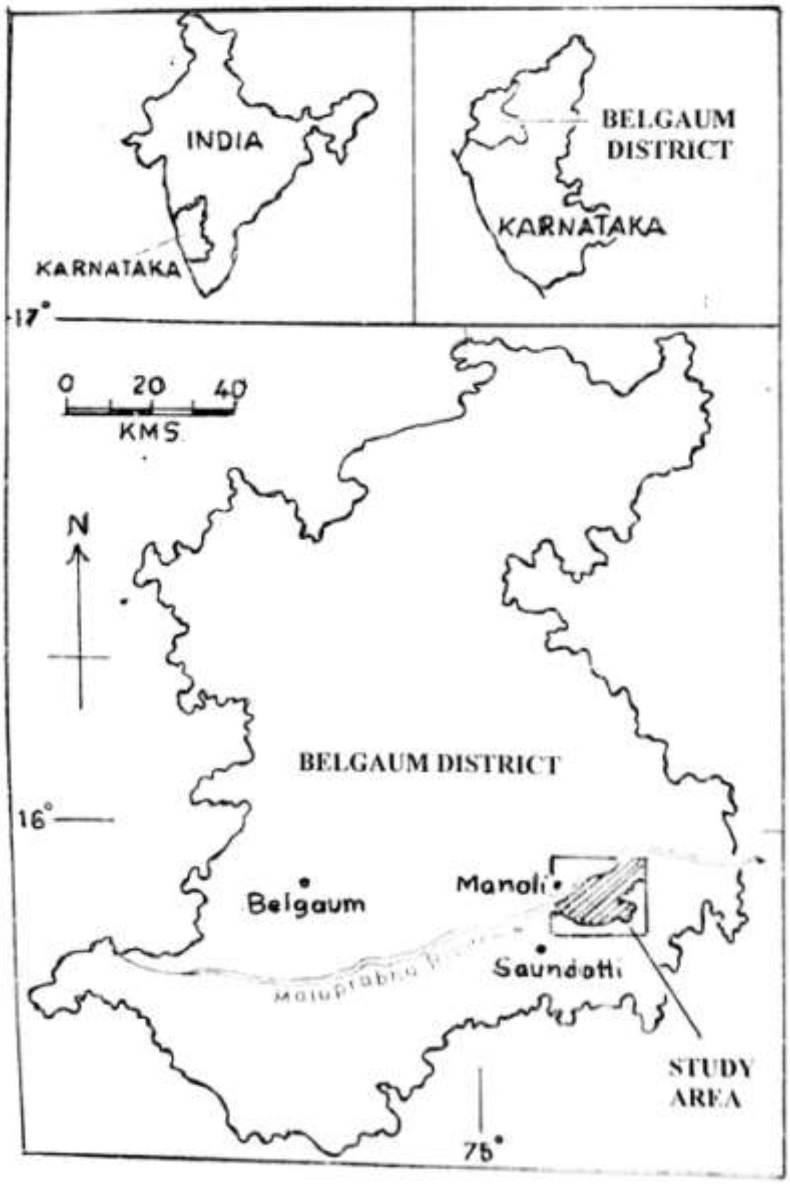


Figure 1(b): Location map of study area

with an angular unconformity (Fig 4 b). The Archaean gneisses are seen to be traversed by basic igneous dykes but these intrusions do not cut across the sedimentary rocks. Morphologically also a clear distinction is noticeable between the gneisses and the sedimentary rocks. Based on the disposition of the primary sedimentary features like current bedding, ripple marks and graded bedding, the sedimentary beds are observed to be in the "right-side-up" position. The maximum height attained in the region under study is 784 meters, which is located west of Huli village and is right on the southern border of the study area. The lowest elevation is 580 meters. This has enabled the rocks to be exposed over a thickness of about 200 meters and thus create an opportunity for detailed geological investigations. The broad linear structures are delineated with the help of satellite imaginaries and the field evidences are collected to decipher the ground truth. However, the study has revealed that wherever valleys have been formed, these are invariably along sheared and ruptured quartzarenitic rocks.

II. STRUCTURAL FEATURES

The structural features developed in thequartzarenites like disposition of strike and dip displacements in the form of faults and shear zones as well as shatter zones; brecciated horizons, dykes etc. have been recorded and represented in structural geological map given below (fig 2).

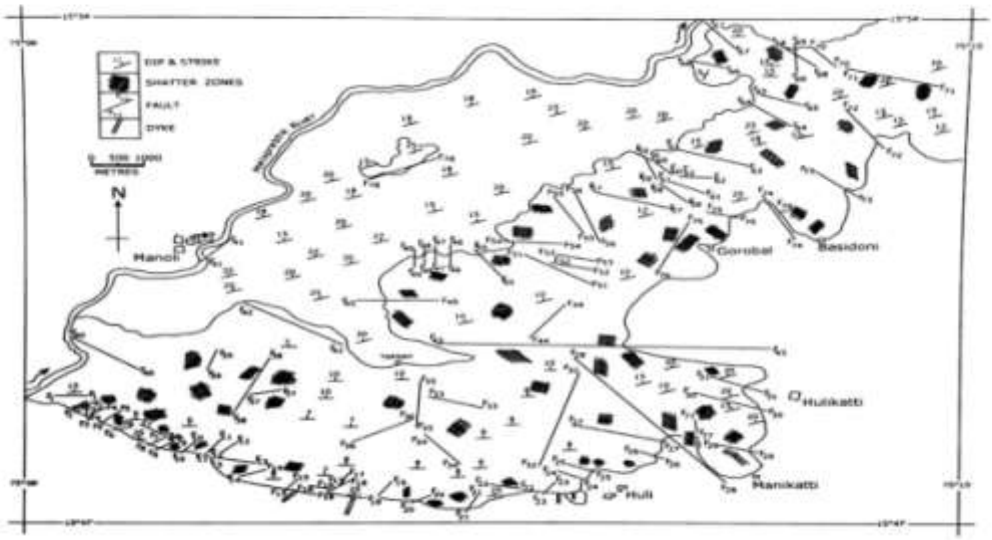


Fig. 2: Map representing the salient structure features

III. DISPOSITION OF STRIKE AND DIP

In the study area the quartzarenitic rocks havetwo preponderant direction of strike, viz., E-W in the southwestern part and N70°E-S70°W in rest of the area, and similar to the trend of strike of the rocks, only two directions of dip have been encountered, these being north and N 20˚W. The amount of dip shows a change from 6˚ to about 35˚.In the southwestern part, the amount of dip is low and is found to vary between 6˚ and 10˚. In the southeastern part, near Hulikatti and Manikatti villages, the amount of dip is found to increase, the range being between 10˚ and 30˚. The rocks have a different direction of strike from that present in the southwestern part, the trend in the southeastern part being N70˚E-S70˚W. It is significant to note here that in the immediate western vicinity of Hulikatti and Manikatti villages, a fault running over along distance of about 3 kms has been located and is marked as F_{28}-F_{28} (Fig.2). To the immediate northern proximity of Hulikatti, another major fault running over a distance nearly double that of the fault F_{28}-F_{28} has been recognized, this latter fault being marked as F_{43}-F_{43} (Fig.2). It is therefore argued that the change in the direction of strike and increase in the amount of dip might be the effect of faults F_{28}-F_{28} and F_{43}-F_{43}. In the central part, the amount of dip is nearly monotonous, the range being between 10˚ and 15˚. In the northeastern part, the rocks have registered a considerable increase in the amount of dip, which in relative terms may be called 'high'. The lowest recorded dip in this part is 15˚ and the highest is being 35˚. The rocks in this region also have a N70˚E-S70˚W strike. Apparently, a greater number of faults are recorded in this part as compared to those found in the southeastern part. Therefore, the greater intensity of faulting may be the cause for the increase in the amount of dip in the said region. In the northwestern part, a monotony of dip amount is experienced, it being around 20˚ to 22˚. However, in this part the overall amount of dip is high. Thus the disposition of the amount of dip in the entire region under study produces a pattern such that the rocks with low angled dip are restricted to the southwestern part and in the remaining part the amount of dip is high. A somewhat vague relationship is apparent between increased dip amount and change in the direction of the dip and development of rupture structures like faults. The drainage pattern of the study area is also structurally controlled exhibiting rectilinear or rectangular pattern, depicted in Fig. 3. The non-perennial streams have either an E-W or an N-S direction of flow. It is pertinent to note that the rocks trend in a general E-W direction with a northerly dip. In keeping this attitude, the non-perennial streams appear to have been controlled by the said attitude of the rocks. There are departures from the generalized N-S or E-W directions of flow for the non-perennial streams which join ultimately the MalaprabhaRiver.

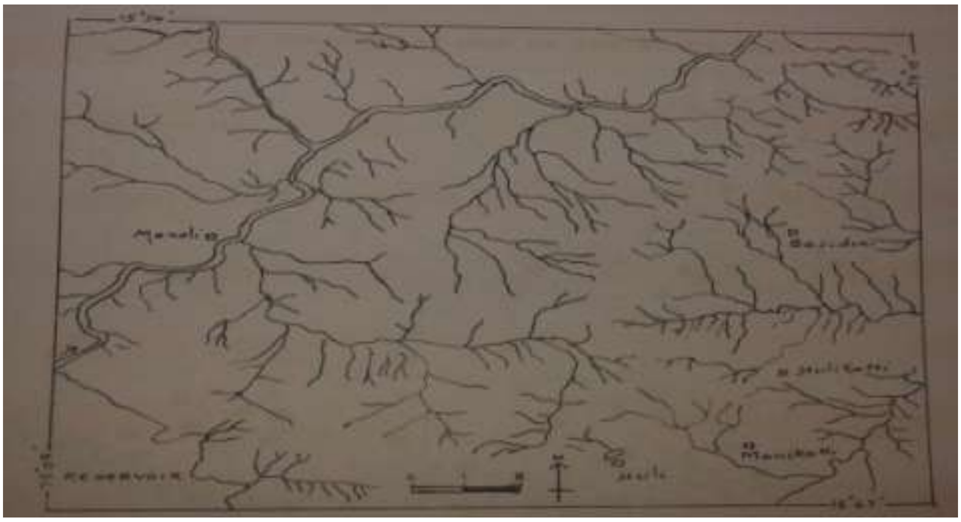


Fig 3: Drainage pattern of the study area.

The Malaprabha River has incised a gorge which is about 60 meters deep in the quartzarenites at the commencement of Kaladgi basin on its southern border, notwithstanding the resistance offered by the hard rocks. Therefore, the said gorge incised by the river is decidedly along a weak structural plane, like a fault. This has been described by the earlier workers as a ***"Peacock Gorge"****(fig 4: a)* (Foote, op.cit) where in the Indira Gandhi dam has been constructed across this river.

Fig 4:(a) Peocack gorge insized by Malaprabha River in quartzarenites.

(b) Angular unconformity

RUPTURE STRUCTURES

The quartzarenitic rocks constituting the area under study are quite suitable for the development of faults as the rocks are competent ones. Further the area being devoid of much vegetation, presence of several quarries together with the presence of many non-perennial streams, straight cut valley **(Fig 4 a)**, slickside surfaces, striations, change in dip amount, bracciation etc. have rendered it possible to identify numerous faults in the field. However, about 2 kms northwest of Basidoni village, almost a horizontal slickenside surface has been encountered, which is very much extensive in nature. This slickenside surface is almost coinciding with the bedding planes of the quartzarenites and typical bluish green patches of pseudotachylytes have also been developed. In addition, there are two striations trending in two different directions which are N35˚W- S35˚E and N75˚E- S75˚W. A bedding plane fault **(Fig 6 b)** has been recognized at this spot, which probably is the only instance of its kind. This bedding plan fault might be an impact of long E-W trending fault (F_{43}-F_{43}) **(Fig 6 c)** belongyekkerihulikatti road which forms a suture line or line of join in the differential upliftment of south central Kaladgi Basin. It is pertinent to note here that a narrow straight cut valleyadjoiningthe said line of join also marks the subsidiary faults (F_{28}-F_{28}) due to the impact of differential upliftment.Thequartzarenites exposed around Saundatti town have also a remarkable rupture structures like sinistral faulting, peacockgorge, faults at Sirasangi, mullurghat, a fault with high dipping beds, shattering and gouge in the vicinity of jogalbhavi,**(fig)**, high angle fault parallel to the earlier, ruptured valleys surrounding yallammaguddaand vertical cliff due to faulting and shearing (lineament) in Parasgad fort at southern tip also are evidences for the said differential upliftment. By far more convincing evidence in the recognition of faults is offered by the rupturing of the rocks through the process of shearing movements. It is logical to expect that during the movement of one block over another, considerable resistance will be offered by the rock during its rupturing. Hence, the shearing forces cut up the rocks into different directions and result into the production of angular fragments of rocks, big and small alike. Such rocks are customarily described as 'fault-breccia'. A careful look at Fig.2 reveals that there are 'peripheral faults', 'parallel faults', 'radial type of faults', 'intersecting faults' 'fan-shaped faults', 'major and minor faults', 'vertical faults', 'bedding-plane faults' 'oblique faults', 'dip faults', 'strike faults', 'strike-slip-faults', 'dip-slip faults', 'complex slip faults', etc. The faults developed in the area under description possess different frequent-cum-preferred directions of trend, which probably indicate varying intensities of stresses developed by the deformative forces that had acted on the rocks of the region. Faults and shears are described together for the simple reason that these are found in the vicinity of each other. This feature can be very well observed in Fig.2, wherein in the vicinity of almost every fault, one, two or more shatter zones are seen to be developed. The causative factor for so much rupturing, shearing and faulting might be attributed to differential upliftment of the S centralKaladgi basin.

IV. DIFFERENTIAL UPLIFTMENT OF S CENTAL KALADGI BASIN

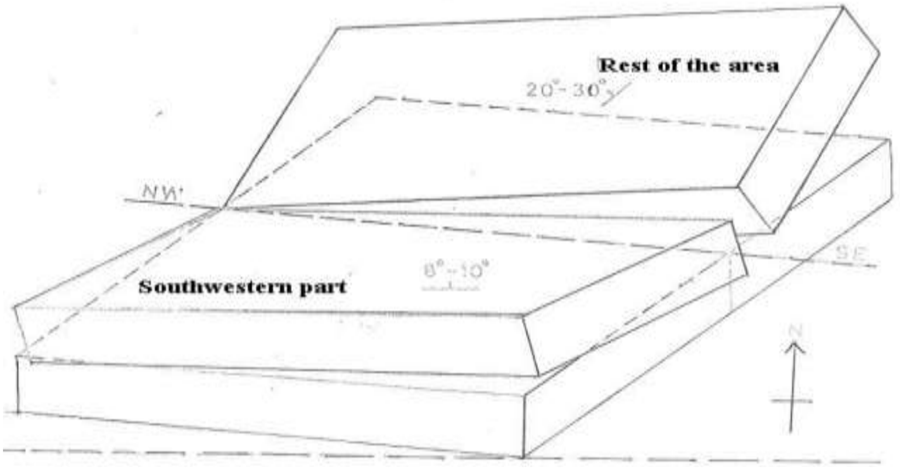
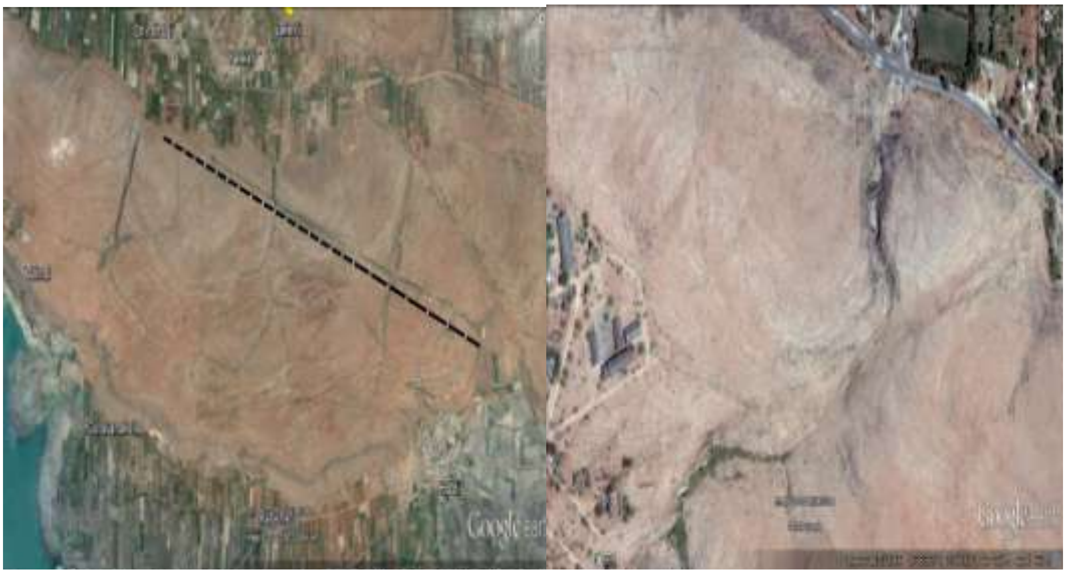


Fig 5: Hypothetical Block diagram depicting the differentialupliftment of the southwestern part and rest of the area of south central Kaladgi basin

The quartzarenites exposed in the study area have been observed to be highly sheared and faulted indicating thereby the action of strong deformative forces. Rupture structures dominate the area and a main structural feature is associated with other structures. There is a definite genetic relation between the different rupture structures encountered in the rocks. It is not sufficient to merely describe the intensity and style of deformation, but also to infer the direction and kind of the deformative forces that gave rise to the structures. An attempt is made to explain the genesis of the different structures and tentatively derive the intensity, kind and direction of the deformative forces that have given rise to them.

Fig 6:(a) Straight cut valley(b) Bedding plane fault showing psudotechalites



(c) Line of join of differential upliftment ((F_{43}-F_{43}). (d) Lineament at Parasgad

The quartzarenites exposed in the study area trend nearly E-W for the more southwesterly part and ENE-WSW for the rest of the area. As a result of this, the direction of dip also varies from a general north for the southwestern part, to a general NNW for the rest of the exposures. It is argued that when the different beds were first laid in the basin of sedimentation, the layers were nearly horizontal, and during the subsequent upliftment of the basin, the inclination was probably acquired by the rocks. It has been noted that the Kaladgi basin extended in an E-W direction and that the rocks of the basin possess a northerly dip, which is due to the upliftment more on the southern side and less so on the northern side of the entire basin. This mechanism however has to result in the development of only E-W strike and a northerly dip. But in the area under study, portions other than southwestern part have an ENE-WSW strike and NNW dip. It is therefore suggested that there was a differential upliftment of the basin; the more southwesterly part was uplifted in the southern border, while the southeastern border of the basin was uplifted more on the southeastern part than on the northwestern part. Such an upliftment can then result in a northerly dip for the southwestern part and a NNW dip for rest of the area. These features are presented in the block diagram given above. It is important to note than not only the direction of dip is different but even the amount also is

(e) Ruptured valley around yallammagudda (f)lineament at Parasgad

considerably different, for the southwestern part and that for the rest of the area. A look at Fig.2 reveals that the rocks of the southwestern part possess a low dip of 6˚ to 10˚, while those of the rest of the area have developed inclination which varies from 15˚ to 35˚. Such a disposition of dip amount also strongly supports a differential upliftment of the rocks, less for the southwestern and more for the rest of the area. This mechanism will result in a low northerly dip for the southwestern part and a relatively higher NNW dip for the rest of the area. The 'line of join' of the southwestern and southeastern parts can naturally expect to produce structures other than the inclination for the rock types. Due to the differential upliftment along this line, fault (displacement) can be expected. In fact the fault F43-F43 and F28-F28 (Fig.2) are certainly located at and around the said 'line of join'. Therefore in all likelihood the differences in the direction of strike, those in the direction of dip and those differences in the amount of dip are the outcome of differential upliftment of the southwestern and the southeastern parts of the area under study. As the rocks of the region are actively faulted in different directions, changes in the directions of dip, strike and amount have taken place in the vicinity of some of the faults.

V. CONCLUSION

From the foregoing account, it is inferred that multitudinous rupture structures are encountered in the quartzarenites belonging to Kaladgi Group exposed in the vicinity of Saundatti and Sirasangi,Balgaum district Karnataka state. The detailed geological investigations carried out reveal the presence of faults, shears, shear zones, shatter zones etc. in quartzarenites and also a change in strike directions, dip directions and dip amount which are the impact of the deformative forces enacted upon the horizontally laid beds in Kaladgi basin. The study area formulates S central portion of southern edge of Kaladgi basin bear the signature of the differential upliftment of the rocks evidenced by multifarious rupture structures and a line of join or suture line in the form of fault (F_{43}-F_{43}). The satellite imagery of the study area from Google earth is also in accordance with the rupture structures encountered during the field study support the differential upliftment of the S central Kaladgi Basin.

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