SCHOOL OF EARTH, OCEAN AND ATMOSPHERIC SCIENCES

GOA UNIVERSITY

Exam: Roll No:

LABORATORY CERTIFICATE

This is to certify that ~~Mr.~~ /Ms. ASHITA N. SALGAOKAR has satisfactorily completed the course of practical for M.Sc in Applied Geology.

Experiments conducted are pertaining to paper FIELD MAPPING (AGTC-407)

Practicals prescribed by the University for MSc PART I class, during the academic year 2022-2023

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REPORT ON GEOLOGICAL FIELD MAPPING AND FIELD WORK CARRIED OUT IN AND AROUND BAGALKOT KARNATAKA.

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INTRODUCTION

The Proterozoic (Purana) basins are a unique feature of the Proterozoic geology of the Indian Peninsular Shield. There are seven independent sedimentary basins in India which were collectively known as Purana Basins. The words 'Purana Basins' refer to the most of the subhorizontal Pre-cambrian sedimentary sequences deposited over the crystalline basement of gneisses, granites and schists. The Vindhyan, Cuddapah, Bhima, Chattisgarh and Kaladgi basins are the important Purana Basins. The field trip has been organised choosing the Kaladgi Basin which is present at the northern edge of the Dharwar craton.

Kaladgi basin is an E-W trending irregular basin underlain by the basement granitiod (Peninsular Gneiss and Dharwar Batholith) of the Dharwar Craton in the South and East and Overlained by the Deccan Trap in the North. The basin covers an area of 8300sq.km is made of an older Kaladgi sequence and the younger Badami Sequence occurring is separate sub Basinal area, like the older Cuddapah and younger Kurnool sequence is the Cuddapah basin. Unlike the other Purana basins Kaladgi basin is not marginally deformed, as it is not spatially associated either with mobile belt or with terrance boundaries.

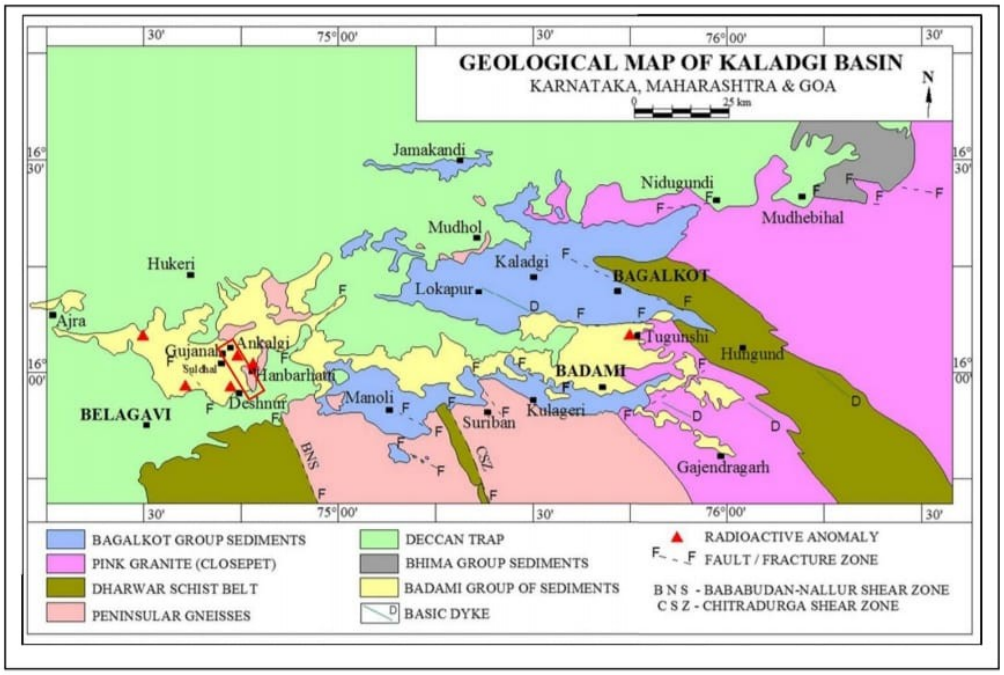


Figure 1.1 Geological map of Kaladgi Basin (after Jayaprakash 2007)

Geological Setting:

The Kaladgi Supergroup comprises of cyclic sequence of mainly arenites, shales and carbonates deposited in shallow marine cratonic environment (Vishwanathan, 1977; Jayaprakash et al.1987; Sathyanarayana, 1994; Kale et al. 1996). The Supergroup is divided into Bagalkot and Badami Groups. Broadly three cycles of sedimentation are recognized within the supergroup, represented by the Lokapur and Simikeri Subgroups, and the Badami Group. Each cycle starts with conglomerate and arenite followed by alternate intercalations of shales and carbonates. The basement for the Bagalkot Group comprises of Archaean Peninsular Gneiss, The Hungund Kushtagi schist belt is dominated by metabasalts with subordinate felsic volcanics (adakites), meta-ultramafics and metasediments (Naqvi et al. 2006). The Dharwar belt is dominated by Chitradurga Group metagreywackes, metapelites and metabasalts. The Closepet Granite consists of K- and LILE-enriched granodiorites (sanukitoids) and granites (Jayananda et al. 1995; Dey et al. 2003; Dey, 2006). The Badami Group is deposited after the deformation and upliftment of the Bagalkot Group. This younger Group comprises of undeformed horizontal to gently dipping sediments resting with an angular unconformity over the Bagalkot Group as well as the Archaean basement.The source of the Bagalkot Group is the NNW-SSE trending Archaean granitoids and schists encircling the Basin as evidenced from the centripetal palaeocurrent directions (George, 1999). Along the northern margin,

the basal Salgundi Conglomerate and Saundatti Quartzite contain profuse fresh detrital potassic feldspar derived from a restricted, less weathered K-rich granitic source (Dey, 2006; Dey et al. 2008). In contrast, along the southern margin these members are more mature (quartzrich) derived from a peneplained, highly weathered mixed source consisting of gneisses, granites and schists. The Muchkundi Quartzite, occurring up in the succession, is highly mature and indicates severe weathering of the source (Dey, 2006). The Badami Group is formed by erosion of both the Archaean basement and the Bagalkot Group.

Supergroup	Group	Subgroup	Formation	Member	Thickness (m)
Kaladgi	Badami		Katageri	Konkankoppa Limestone	85
				Halkurki Shale	67
				Belikhindi Arenite	39
			Kerur	Halgeri Shale	3
				Cave-Temple Arenite	89
				Kendur Conglomerate	3
	---------- Angular unconformity ---				
	Bagalkot	Simikeri	Hoskatti	Argillite	695
			Arlikatti	Lakshanhatti Dolomite	87
				Kerkalmatti Ferruginous Member	42
				Neralkeri Chert	39
				Govindkoppa Argillite	80
			Kundargi	Muchkundi Quartzite	182
				Bevinmatti Conglomerate	15
		---------- Disconformity -			
		Lokapur	Yadhalli	Argillite	58
			Muddapur	Bamanbudni Dolomite	402
				Petlur Limestone	121
				Jalikatti Argillite	43
			Yendigere	Nagnapur Dolomite	93
				Chikkashellikere Limestone	883
				Hebbal Argillite	166
			Yargatti	Chitrabhanukot Dolomite	218
				Muttalgeri Argillite	502
			Malaprabha	Mahakut Chert	133
				Manoli Argillite	61
			Ramdurg	Saundatti Quartzite	383
				Salgundi Conglomerate	31
---------- Non-conformity ----------					
Archaean granitoids, gneisses and greenstone belt metavolcanic and metasedimentary rocks					

After Jayaprakash *et al.* (1987), Jayaprakash (2007).

Table 01: Litho-stratigraphy Of Kaladgi Supergroup

FIELD OBSERVATIONS

Day 01, 10 December 2022

Location 01: Karadigudda (Belgavi-Bagalkot Road), nearly 800 mts above MSL.

GPS Readings- 15°52'51"N-74°41'41"E

The area was covered by dried vegetation.

Dominant rock present here was conglomerate which is a part of Simikeri subgroup this conglomerate is also known as Bevinmatti conglomerate. There is a variation in matrix and clasts size of the conglomerate. Clast composition is of milky quartz. There was a variation seen in matrix from base to the top, at the base it was siliceous and as we moved up it was ferruginous. At the base the conglomerate was matrix supported (para conglomerate) and at the top it was clast supported (ortho conglomerate). There were layers of varying thickness within the rock. Presence of a conglomerate indicated an Unconformity.

Location 02: Roadcut section along the same Belgavi-Bagalkot Highway.

GPS Readings- 15°52'37"N-74°41'49"E

There were conglomerate present here having clasts of size greater than 15cm, it was a clast supported conglomerate. There was Deccan trap basalt present here which was fine grained and has vesicles present it had undergone spheroidal and exfoliation type of weathering. The outcrop had fractures present.

PHOTOPLATES:

Conglomerate at location 01 showing milky quartz clasts. (pencil for reference pointing North)

Spheroidal Weathering in Deccan trap basalt. (Human scale for reference)

Day 02, 11 December 2022

Location: Ramthal

Spot 01 Base Of The Hill.

GPS Readings-

The objective of visiting this location was to observe the basement of Kaladgi. The basement that was identified was Hundung Schist Belt which is made up of metavolcanics with ultramafics which have been metamorphosed. The most lithology exposed here was BIFs and Conglomerates. As we moved along the basement various lithologies were encountered such as BHQ phyllite (chipped), steeply dipping phyllite which were dipping NE, folding of BHQ along the basement, almost one or two feet long milky quartz vein was seen. There was a slight curvature seen in the chipped phyllite of which data was collected. The data is given in the table below;

Reading No.	Strike	Dip Direction	Amount of dip
01	N163°	NE	76°
02	N143°	SW	40°
03	N164°		80°
04	N165°		64°
05	N175°		85°

Table 02: Readings of Chipped Phyllite.

The BHQ that was folded was a shallow dipping fold on which readings were taken and are shown in the table;

Reading No.	Strike	Dip Direction	Amount of dip
01	N161°	SW	38°
02	N133°	SW	76°
03	N153°	SW	40°
04	N148°	NE	20°

Table 03: Readings of Folded BHQ.

Spot 02: 100 mts from the base.

GPS Readings- 16˚14’54’’N-75˚39’45"E

The core of the anticline shows exposure of ‘Banded Haematite Quartzite’ belonging to the older Hundgund-Kushtagi schist belt. They show metallic lusture and the non shiny part shows granulose texture. They exhibit Banded Iron Formations(BIF). There are layers of competent and incompetent beds with shallow plunge with the dip amount of 24° dipping in the direction of N333°.After climbing up the hill Unconformity was exposed which had clasts of BHQ with varying size between 1 to 15 cms.

Spot 03: Caliche Deposits Ramthal

GPS Readings- 16°04'51"N-75°52'12"E

The area was in dried condition. It had non crystalline variety of $CaCO_3$. No other clevage possessing minerals were seen. Smoky quartz (vitreous lusture and concoidal fracture) and amorphous calcite was observed by doing the effervescence test by putting 2/3 drops of HCl on the mineral.

Spot 04: 500 mts from spot 03.

There were intrafolial folds present along the roadcut.

The data on the limbs of the folds are given in the table below:

Reading No	Strike	Amount of dip	Dip Direction
01	N220°	34°	NW
02	N306°	40°	NE
03	N320°	74°	NE

Table 04: showing readings of limbs of fold.

PHOTOPLATES:

Smoky Quartz Vein almost a foot long (pencil for scale pointing North).

Chipped Phyllite.

Kaliche Deposits (Hammer Used As Scale)

Conglomerate showing BIF, Siliceous clasts.

Day 03: 12 December 2022

Location: Nargund

Spot 01: Base of a hill.

GPS Readings- 15°44'22"N-75°22'28"E

The rock exposed here is metamorphic phyllite intercalated with BIFs. The rock is foliated in which the minerals have arranged themselves. The strike is N329° having dip amount 74° and dip direction SW.

The readings on other parts of the same outcrop were:

Strike	Amount of dip	Dip Direction
N168°	85°	SW
N152°	70°	NE
N160	76°	SW

Table 05 Showing Readings Of Foliated Phyllite.

There is a broad warp in the foliation therefore the strike is changing and the dip is varying by almost 10°. The foliation is penetrative in nature. There are quartz veins seen which are parallel to the foliations. The phyllitic rock has not undergone more than greenschist facies metamorphism. And as the foliation planes are planes of weakness it was easy for the quartz vein to intrude. The intrusion of quartz vein is synchronous with the deformation of rocks.

There is a small scale horizontal shear zone. This zone could possibly be the reason behind change in readings of strike and dip.There are 3 deformation fabrics; Sn (most penetrative), Sn-1 (preserved only in few places) and Sn+1 (spaced fabric). The rocks here are associated with Kaliche Deposits. An unconformity is present here of recent age and not a part of Kaladgis. Reverse graded bedding is seen where the below layer is made of fine sediments and the top layer is made of bigger sediments. Quartz vein is becoming shallow/horizontal as we move up this can be due to the role of fluids or slumping of vein.

Strike	Amount of Dip	Dip Direction
N150°	84°	SW
N145°	65°	SW
N150°	46°	SW

Table 06 showing data on foliation and quartz vein.

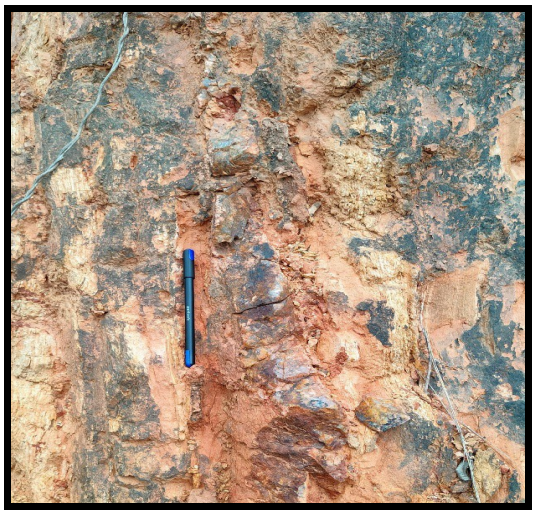
Spot 02: Near the windmills, 800 mts above MSL.

GPS Readings- 15°43'49"N-75°22'46"E

The outcrop exposed here consisted of numerous sets of joints and fractures. The rock exposed here was quartzite and at some places it was ferruginous sandstone. Trend of joint set were N121°, N225°, N252°. At this spot ripple marks and harringbone structures were seen.

PHOTOPLATES:

Ripple Marks (pen used as a scale pointing North).



Quartz vein parallel to the foliation (pen used as a scale pointing North)

Recent Deposits (Reverse Graded)

Day 04: 13 December 2022.

Location: Aiholle

Spot 01: Southern side of the roadcut.

GPS Readings- 16°00'48"N-75°53'05"E

The rocks exposed here were reddish brown in colour. Dried vegetation was present here and the beds were inclined in nature. The strike and dip data was collected on the inclined beds which is presented in the table below;

Strike	Amount of dip	Dip Direction
N116°	46°	SSW
N114°	36°	SSW
N107°	38°	SSW

Table 07 Showing Strike Dip Data on Inclined Beds.

There were small patches of unconformities between the rocks in this incline formation which is a part of Bagalkot Formation. The conglomerate within a formation is known as an intraformational conglomerate, it had clasts of feldspar, jasper, chert, BIF and quartz and the size of clasts were between 1 to 5 cms. The intraformational conglomerate was present in 6/7 layers. Cross bedding structure was also present.

Spot 02: Northern side of the roadcut.

The exposure here was horizontal in nature and has a small dip of almost 4/5°. The rock here was mostly siliceous sandstone and at some places it was ferruginous sandstone (showing red colouration). The exposure was highly weathered and at places it was foliated and could break easily if it was hit with a hammer.

Location: Sirur

Spot 01: Next to the temple.

GPS Readings- 16°05'34"N-75°46'58"E

The outcrop next to the temple was expansive one made up entirely of Quartzite. A fault plane was observed that was indicated by the presence of Striations. Lineation on fault plane could be seen which is called the surface lineation. Slickenslides were also observed, as there were no offset markers the type of fault could not be identified. But by using Anderson's theory of faulting it was identified to be a reverse fault. The observed joint sets were conjugate joint sets.

Horizontal Strata Of Badamis.

Inclined Beds of Bagalkot Group.

Clasts Of Intraformational Conglomerate (1₹ coin kept for scale purpose).

Striations (2₹ coin kept for scale).

Day 05: 14 December 2022.

Location: Amingad

GPS Readings- 16°03'31"N-75°56'53"E

The exposure here was of closepet granite. There were boulders of this granite which were pink in colour and showed porphyritic texture. It contained mostly quartz and orthoclase feldspar as essential minerals and accessories were biotite and hornblende. There was a xenolith entrapped within the granitic body which was about 10 cm long and 7 cm wide. There were joint sets present which had a strike reading N356° having dip amount 74° towards ESE.

Location: 10 kms away from location 01.

GPS Readings- 16°06'93"N-76°05'06"E

The rock exposed here was part of Hungund schist belt that had BIF with more iron concentration if compared to the previous spots. There was also a quartz vein which was crosscutting the formation. The bottom part of this outcrop had BHQ's where as the top part had phyllites. Intrafolial folds were present. The beds here were striking in the N125° in the NNE direction dipping by 55°.

Closepet Granite (Pen used as a scale)

Joint set (pen pointing North).

Day 06: 15 December 2022.

Location 01: Bilgi Karnataka

GPS Readings- 16°20'43"N-75°37'02"E

The exposure here was mostly grey in colour and there was scanty vegetation, a dried stream was present. The rock exposed here was a grey granite which has exfoliation joints, xenoliths entrapped and veins that had intruded in it. This granite was a closepet granite rich in Na and some amount of K. The xenolith that were entrapped were accidental type and had composition of pyroxene and hornblende. The vein that had intruded was felsic as it contained quartz and orthoclase feldspar, it was coarse grained, 20/25 cms thick and was curved in nature, it's trend was N48° and N50°. The vein was identified to be a Pegmatitic vein. Besides this there were joint sets present which had trend of N80°, N86° towards EW. The vein had a minute displacement, north side seems to have moved down and the southern side has moved up. It was a dextral movement.

At one spot a Xenolith within Xenolith was observed, the outer boundary was dark in colour while the inner core was white in colour.

Location 02: Quarry, opposite Siddheshwar Temple.

GPS Readings- 16°33'72"N-75°36'50"E

This location was about 200 mts from location 01. The vast exposure of the outcrop has undergone low grade metamorphism. The whole outcrop had 2 prominent joint sets, one along the bedding plane and the other joint is vertical across the bedding plane. The Saundatti Quartzites are separated from the Clospet Granites by a nonconformity. It is a metamorphic rock with granulose texture. The Saundatti Quartzites exhibit pinkish feldspar rich sandstones at the base followed by quartzitic sandstone exposed at the quarry. The beds are horizontal, well bedded and show numerous primary sedimentary structures like ripple marks and cross bedding.

Location 03: Behind School.

GPS Readings- 16°20'29"N-75°36'58"E

The exposure present here was pink and buff in colour. There was intraformational conglomerate present which had clasts of quartz 3 to 12 cms in size. Primary structures such as cross bedding and normal graded bedding was seen. The rocks here have undergone cyclic decomposition. Syndepsitional primary structures were present.

Accidental Xenolith (pen kept as a scale pointing North).

Pegmatitic Vein (Clinometer kept as scale).

Xenolith Within Xenolith (pen cap kept as scale).

Quarry Opposite Siddeshwar Temple.

Day 07: 16 December 2022.

Location: Shirur

Spot 01:

GPS Readings- 16°05'47"N-05°48'7"E

The rock exposed was Quartzite which was pink in colour which was highly fractured . It had numerous joint sets which were 2 mtrs Or more in size. Two prominent joint sets were observed, one was parallel to the bedding and the other was perpendicular to the bedding plane. There were conjugate as well as orthogonal joint sets. Veins were also present which were made up of quartz. The orientation of mineral vein and the rock vejn was different. The veins were coarse grained. As we moved further about 200 mts, Crosscutting of veins could be seen here which were made up of quartz. There were 2 veins at this outcrop, one was parallel to the foliation and the other was cross cutting across the foliation.

Spot 02: About 300 mts from previous spot.

GPS Readings- 16°05'05”N-75°48'50”E

Rock was exposed over a large area where there was a lot of vegetation around. The rock exposed was pink Granite which was not foliated where as the other rock had schistosity which was Biotite Schist. Granites had intruded the foliated rock.

Spot 03: Murdi

GPS Readings- 16°02’06”N-75°45’26”E

The vegetation was sparse here and the area was very dry. The spot was just next to the highway. Expansive outcrop of Quartzite was exposed. It had intraformational conglomerate. Joint sets and fractures were present. Joint sets were orthogonal. Joints were trending in N180° direction. In the same area Sandstone was also present which was white in colour.

Spot 04: Niralkeri, approximately 5 kms away from spot 3.

GPS Readings- 16°04'28"N-75°42'10"E

At this outcrop phyllites were exposed which were red in colour. Red colour indicates that it is Ferruginous. The beds were dipping in SSE direction.

Ferrugineous Phyllite.

Day 08: 17 December 2022

Location: Kagalkomb 10/12 kms from Bagalkot.

Spot 01: 100 mts from roadside.

GPS Readings- 16°06’51”N-75°38’24”E

After walking away from the road ,the rock exposed here was milky white in colour having vitreous lusture, concoidal fracture and there was no clevage present. At some places well formed hexagonal crystals were found. The exposure was highly weathered and jojointed.The readings of joint sets was taken N151° and N105°. Radiating pattern was shown by Quartz.

At few places local deformation had taken place and there were extension cracks that had formed on the outer arc and perpendicular tensional cracks had formed. The ridge was trending EW.

Spot 02: Near Roadside.

GPS Readings- 16°07'29"N-75°35'46"E

The exposure was of foliated dolomite. These were dipping S or SSW. The data collected from the foliated dolomite are enlisted in below table;

Strike	Amount of dip
N95°	55°
N105°	53°
N106°	54°
N114°	45°
N104°	44°
N101°	46°

Table 08 showing data of foliated dolomite.

Spot 03: Dolomite Quarry.

GPS Readings- 16°11'76"N-75°64'38"E

This location had rock similar to the previous location which was a foliated dolomite. Active mining of this dolomite was going on. And had data similar to previous spot.

Spot 04: Konkankappa Village/Limestone

GPS Readings- 16°03'09"N-75°38'45"E

Data taken in the surface of the exposure is given in the table below;

Strike	Amount of dip	Dip Direction
N94°	04°	SW
N95°	06°	SW
N92°	04°	SW

Table 09 readings of limestone beds.

Spot 05: Halkurki

GPS Readings- 16°01’13”N-75°38’57”E

There was a dried stream present and the rock exposed here was red in colour and was identified to be ferruginous shale. Laminations were seen on the shale that had colour variation. Very gentle warp along the outcrop was observed having variation of about 2/3°.

Spot 06: Behind Petrol Pump.

GPS Readings- 15°56’18”N-75°40’35”E

The exposure here was horizontal in nature and was identified to be a sandstone similar to the sandstone from the quarry at Bilgi. Cross bedding structures were identified.

Set Of Joints at location 01 (pen pointing North)

Hexagonal Crystal of Quartz (5₹ coin for scale).

Foliated Dolomite (pen pointing North).

Ferrugineous Shale (Hammer Pointing North).

Day 09: 18 December 2022.

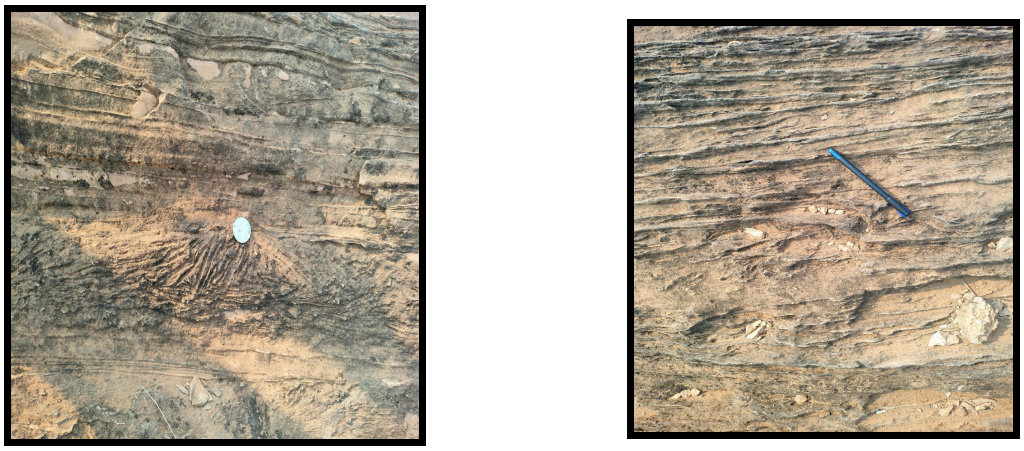
Location: Naganapur-Lokapur.

Spot 01, GPS Readings- 16°10'04"N-75°21'32"E

The rock outcrop present here was brown in colour it appred to be so is because it was highly weathered. When few drops of HCl was dropped on it, the rock showed effervescence and was inferred to be an impure limestone. There were deformed stromatolites present within the limestone which could be 1200 to 900 million years old. There was a cycle of deposition seen, where there was limestone was formed and stromatolites were deposited and this has continued for a long period of time. The rocks were steeply dipping and data was collected from there which is given in table below;

Strike	Amount of dip	Dip Direction
N121°	75°	SSW
N120°	71°	SSW
N125°	71°	SSW

Table 10 Showing Readings Of Steeply Dipping Rocks.



Images showing deformed stromatolites in limestone beds.

Day 10: 19 December 2022.

Location: Vijayapur

GPS Readings- 16°20'28"N-75°55'33"E

Exposure was present just near the road. There was a series of rock exposed here, such as banded gneiss, pink granite, grey granite, pegmatitic vein and quartz vein. The basement was migmatitic which is more than 3 billion years old. Pegmatitic vein is having thickness of approximately 4-6 cms. There were exfoliation joints present. There was displacement seen in the cross cutting veins. A quartz vein was present having thickness of about 4-5 cms.

Pegmatitic veins cross cutting banded gneiss. Also there is displacement seen in the veins (pen kept as scale pointing North).

Quartz vein (pen pointing North).

SUMMARY:

Kaladgis are better known to have Orthoquartzite carbonate association. The sedimentation is in three cycles: Lokapur, Simikeri and Badami. Schists are found relatively in smaller area.

In this fieldwork, we have seen most of the Formations, and correlated it with lithostratigraphic classification. Conglomeratic horizons are prominent in areas which have unconformable contact between two Formations/Groups. Large extent of deformation had taken place in the older sequence i:e in the Bagalkot subgroup which can be inferred from day 2, 3, 7 and 10 field observations.

The younger formations are zero dipping and almost horizontal and an unconformity was seen at Aihole which separated the two from one another.

Dolomites and Limestones which are present are very impure which have buff colour. The stromatolites present in the dolomite indicates that the sedimentation processes started around 1800 million years ago.