GOA UNIVERSITY

2022-'23

AGTC-408

GEOLOGY FIELD REPORT

BAGALKOT, KARNATAKA

Submitted By:

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GEOLOGY FIELD REPORT

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MSc Part I

1]ACKNOWLEDGEMENT

Under the prescribed syllabus of MSc Part I, students of Applied Geology were required to have visit field programme under the subject of Field Geology .It was our great pleasure to visit Bagalkote and its surrounding area.

We would like to express our sincere thanks and gratitude to Department of Applied Geology for providing such an opportunity.

I would like to thank Dr. Anthony Viegas, Dr. Poornima Sawant and Dr. Nicole Sequeira for their constant help, support, interest and valuable hints during the entire field visit .

2] Logistics

A field trip was arranged by the Applied Geology department for MSc part I students of SEOAS, Goa university, which was conducted from 10th December 2022 to 20th December 2022 as a part of syllabus.
All participants boarded a bus from Panjim on 10th December at 09:00 hrs to Belgaum. We did field work on the way to Bagalkote to our place of stay. From 11th of December 2022 the field work would start at 08:00 hrs and would get over by 16:00 hrs.

3] 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.

4] GEOLOGY OF KARNATAKA

Geology of Karnataka is a fascinating subject.Oldest rocks exposed in Gorur area,Hassan district, Karnataka dates back to about 3300 million years.The Precambrian craton of Karnataka is made up of western and eastern segments. The Precambrians of Karnataka have been divided into older Sargur supracrustals (about 3300 to 3000 million year old) and younger Dharwar supracrustals (about 3000 to 2600 million year old.The Dharwar supracrustals Supergroup has been further divided into older Bababudan Group(ca.3000 to 2700 million years) and younger Chitradurga Group(ca.2700 to 2500 million years). The schist belts of the Eastern craton,like Kolar, Hutti,Sandur etc., appear to be approximately equivalent to the Chitradurga Group. The Karnataka craton has been extensively intruded by granites and granitoids of the ca. age 2600 to 2500 million years.The eastern Karnataka abounds in these granites and granitoids.

The northern part of Karnataka is made up of Kaladgi and Badami and Bhima Group of sediments,approximately of Proterozoic age.Further north the terrain is covered by extensive volcanic flows known as Deccan traps of Cretaceous -Tertiary age.

Map of Karnataka

5] REGIONAL GEOLOGY OF THE AREA

The elliptical Kaladgi Basin is situated on the Northern and Northwestern exposed fringes of the Dharwar craton which is composed of strongly deformed and metamorphosed rocks of the Archean and early Proterozoic. The northern and western extents of the basin are concealed under the basaltic lava flows of Cretaceous-Tertiary Deccan Traps. The rocks forming the basement for the sediments of Kaladgi Basin are the Archean and early Proterozoic rocks comprising Older Gneissic Complex,ShimogaSchist Belt, Hundgundkushtagi Schist belt and Younger Closepet Granites. The Kaladgi basin covers an area of 8,300 sq. km and is made of an older Bagalkot Group and Younger Badami Group.

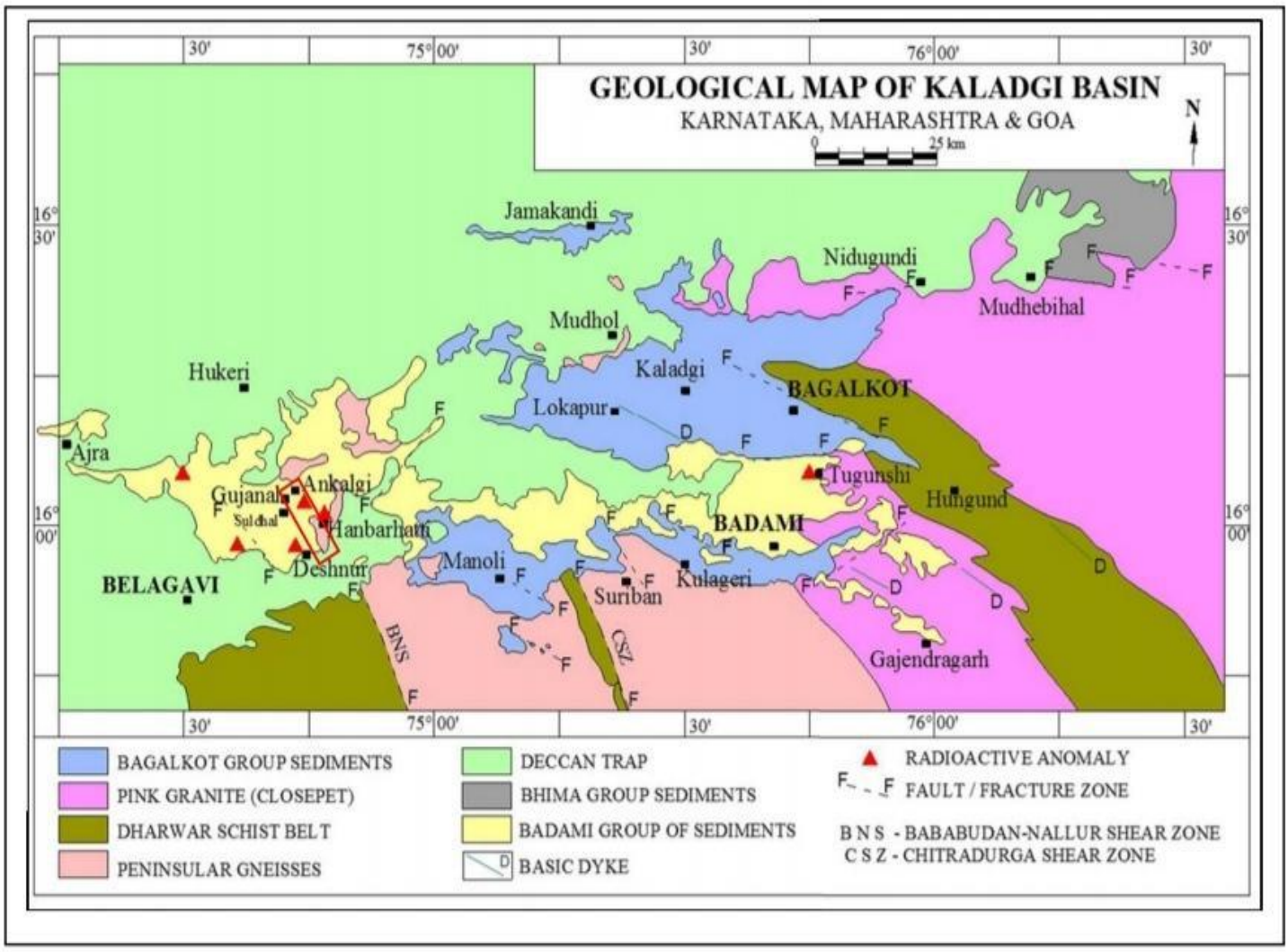


Figure 1.1 Geological map of Kaladgi Basin (after Jayaprakash 2007)

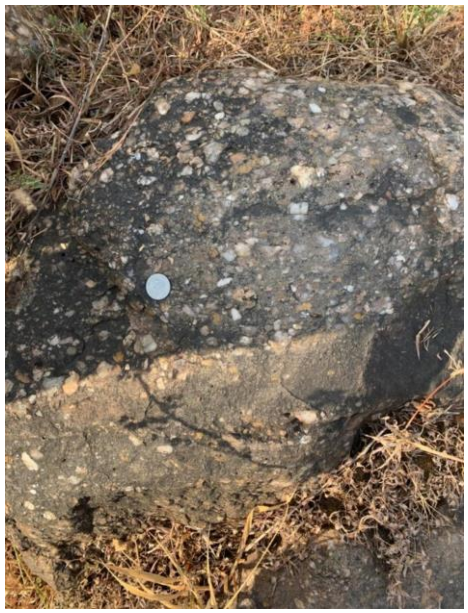
6] Lithostratigraphy of Kaladgi

Supergroup	Group	Subgroup	Formation	Member	Thickness (m)	Sedimentary structures	Sedimentary environment
Kaladgi	Badami		Katageri	Konkankoppa Limestone	85	Profuse cross-bedding (tabular, trough and tangential), ripple marks, graded bedding, parting lineation, sandstone dykes and convolute lamination in Cave-Temple Arenite	Dominantly fluvial with subordinate lacustrine (Jayaprakash 2007; Mukhopadhyay *et al.* 2013)
				Halkurki Shale	67		
				Belikhindi Arenite	39		
			Kerur	Halgeri Shale	3		
				Cave-Temple Arenite	89		
				Kendur Conglomerate	3		
	---------- Angular unconformity ----------						
	Bagalkot	Simikeri	Hoskatti	Argillite	695	Cross-bedding (trough and tabular) and ripple marks (symmetrical and asymmetrical) in Muchkundi Quartzite	High-energy beach deposits grading upwards to tidal flats (Kale & Phansalkar 1991) with minor fluvial deposits (terrestrial fan; Jayaprakash 2007). Dominantly fluvial in the lower part of the Muchkundi Quartzite (Mukhopadhyay *et al.* 2013).
			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	Small- and large-scale cross-bedding (trough and tabular, at places herringbone type), symmetrical and asymmetrical ripple marks, mud and shrinkage cracks, graded bedding, crude parting lineation, rain prints and load casts in Saundatti Quartzite. Erosional parting surfaces and mud cracks in Manoli Argillite (Jayaprakash *et al.* 1987; George 1999; Jayaprakash 2007)	Transgressive beach and intertidal suite with minor fluvial deposits (terrestrial scree and fan deposits grading down slope into braided river sediments) at the base, grading upwards to cycles of alternating carbonate and muddy tidal flat deposits (Kale & Phansalkar 1991; Kale *et al.* 1996; Bose *et al.* 2008).
			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).

7] DAY I
10/12/2022
BELGAUM -BAGALKOTE ROAD

Spot 1 (Karidigudda , near Soman Aiport)
Lat : 15°52'37"
Long: 74°41'49"
The location was at a hill just next to the highway and it had a lot of vegetation and fields around which indicates that there will obviously be drainage. This is a part of Kundargi formation of Badami group which has conglomerates. This conglomerate is known as Bevinmatti Conglomerate which is at a height of 820m. The conglomerate at the outcrop showed variation in the size of clast and the matrix as we moved from the bottom to the toptop of the hill. The conglomerate showed variation from clast supported at the base to matrix supported at the top. The clast size varied from approximately <1 to > 5cm. The mineralogy of the clast was quartz and feldspar on a smaller scale. Presence of Conglomerates indicates Unconformity.



Conglomerate clast

Spot 2 (5-6 kms from spot 1) at the highway
Lat: N15°52'37"
Long: 74°49'49"

This location was just next to the highway which had a dry vegetation around. The outcrop consisted of Rudaceous sized boulders. The conglomerates at this location had a size of around >15cm and it was clast supported. The massive bulbous structure indicated presence of spheroidal weathering that weathered the Deccan trap basalt. Vesicles were also present at this particular outcrop.The basalt showed vesicles and the rocks at this location were highly fractured.

Bulbous structure

8] DAY II
11/12/2022
RAMTHAL

Spot 1
Lat:N16°25'78"
Long: 75°50'88"
The basement here is made up of Hungund Schist belt which is made up of Metavolcanic sediments which are ultramafic in nature. Sediments are present with some acid volcanics, Greywackes with BIF. At this location there was also the deposition of CaCo3 along trenches. The basement is made up of BHQ Phyllite which were seen to be steeply dipping towards NE direction. They were striking in N163° in the NE direction which were dipping by 76° NE.Folding was present along the traverse.

BHQ Phyllite

class 2 folds at spot 1

Spot 2
Lat: N16˚14’54’’
Long:75˚39’45"
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 tecxture. 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°. Conglomerates with BIF's clasts were present. The clasts were 9 cm in length and 3.5 cm in width. The basal part of Badami has an unconformity. Micro folds were also present with a class of chevron folds. Sn is parallel to the axial plane and Sn+1 is the Intrafolial fabric which indicates that the 2 events of folding has taken place. Age:archean

Conglomerate with BIF clast

Layers of competent and Incompetent beds

Spot 3 (500 mtrs away from spot 2)
Lat:N16°75'86"
Long:75°62'60" E

The outcrop here had deposts of Caliche minerals. It had non crystalline variety of CaCO3 which could be Ankerite. None of the minerals had cleavage which indicates that Calcite was absent. These kind of deposits forms in the dry conditions. The presence of CaCO3 was confirmed with the pouring of few drops of HCl on the surface that gave effervescence.

Caliche deposit

outcrop of caliche deposit

9] DAY III
12/12/2022
NARGUND

Spot 1
Lat: N15°43'49"
Long:75°22'46" E
The location was maintained under government guidance which did not have much vegetation around.
The exposed rock is metamorphosed phyllite which in Ingercalated with BIF. The rock has foliated in which the minerals have alligned and arranged themselves well. There is a presence of quartz vein which has intruded the weakly metamorphosed rock. Broad warp in foliation could be seen. The intrusion is synchronous with the deformation of the rocks. The phyllites were striking in the N329° in the SW direction and dipping by 76°.

Quartz vein outcrop of metamorphose d phyllite

Spot 2 (50 mtrs away from spot 1)
The rocks present at this outcrop has caliche deposit. There is an unconformity which is recent in age. A layer of cobble / pebble sized clasts are a part of recent formation. The quartz vein which was present at previous spot becomes horizontal as we move upwards which happens when there is an esrosional surface. There are 3 deformation fabric present at this spot:
(Sn -1) - present at few places which is obliterated
(Sn) - penetrative
(Sn+1) - spaced fabricfabric

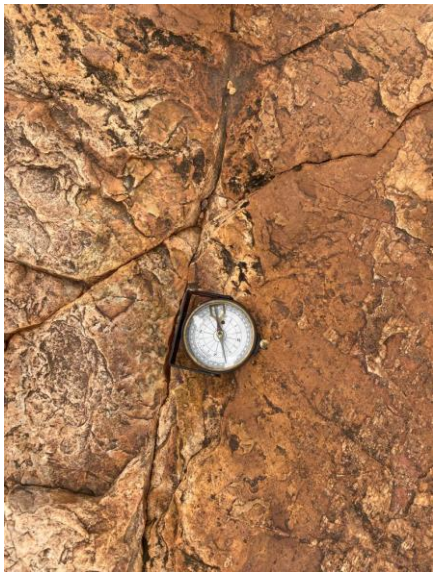
Strike and dip data of the foliation and quartz vein

Strike	N145°	N150°	N150°
Dip amount	65°	46°	84°
Dip direction	SW	SW	SW

Spot 3(300 mtrs from the base of Nargundj)

The outcrop was massive spread across a wide area of about 60 mtrs. The outcrop exposed had a numerous set of joints. The rock which was exposed was Quartzite. Herringbone structures were present.

Outcrop of quartzite



joint trending N285°

10] DAY IV
13/12/2022
AIHOLLE

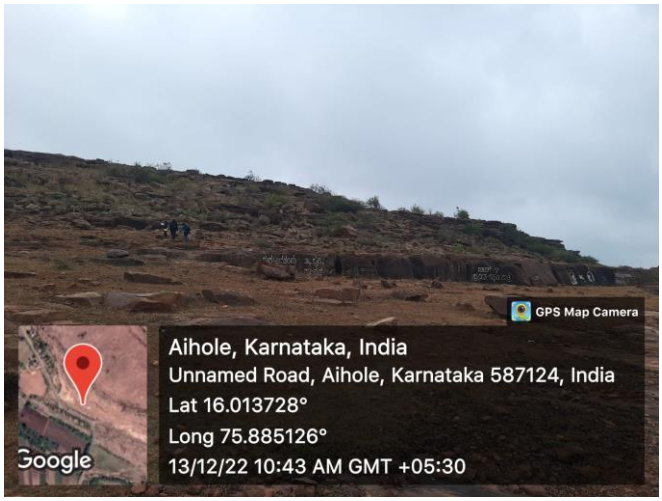
Spot 1 (½ kms from Heritage temple)
Lat: N16°1'48"
Long: 75°53'5"E
On the North side of the road the exposure is massive with horizontal bedsbeds which is a part of Bagalkote and to the South of the road the rocks are inclined which is a part of Badami. The North side and South Side of this area is marked by a Badami - Bagalkote disconformity. The rocks here have not undergone complete metamorphism therefore the grain boundaries are still visible. The length of the exposure is about 40 mtrs and the width is about 15 mtrs. The rock could be named as Quartzite where the sand sized particles are fused together with no distinguishable grain boundaries. The outcrop also consists of intraformational conglomerate within the beds consisting of Cryptocrystalline varieties of Quartz. The Quartzites has a well defined bedding planes dipping SW by 38°. It also has well exposed cross beddings and colour lamination of red colours.

Lamination of colours

Spot 2 (around 50 mtrs away from spot 1)

To the Southern side of the road the Quartzite had a well defined bedding junctions. They also had well preserved cross beddings with variations in clasts across the dip.

Outcrop at spot 2



Spot 3 (Shirur)
Lat:N16°5'34"
Long: 75°46'39"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. By applying Anderson's theory of faulting we could conclude that it was a reverse type of fault. The observed joint sets were conjugate joint sets.

Striations present

11] DAY V
14/12/2022
AMINGAD

Spot 1
Lat:N16°03'22"
Long: 75°56'43" E

The outcrop was expansive and had large boulders of Granite of pink in colour identified by Orthoclase feldspar, Quartz and in association with black coloured mineral which could be hornblende Or biotite. The outcrop of Granite towards NW is not weathered where as towards NE it has undergone extensive weathering with development of joint sets and fractures indicative of presence of shear zones. Xenoliths were present which were mafic in nature and the xenoliths are of Restitic type.

Mafic xenolith

Spot 2 (10 kms away from previous spot)
Near Adarsha School
Lat: 16°06'93"
Long:76°05'06"

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°.

BIF with more iron concentration

12] DAY VI
15/12/2022
BILGI

Spot 1
Lat: N16°20'43"
Long: E75°37'02"

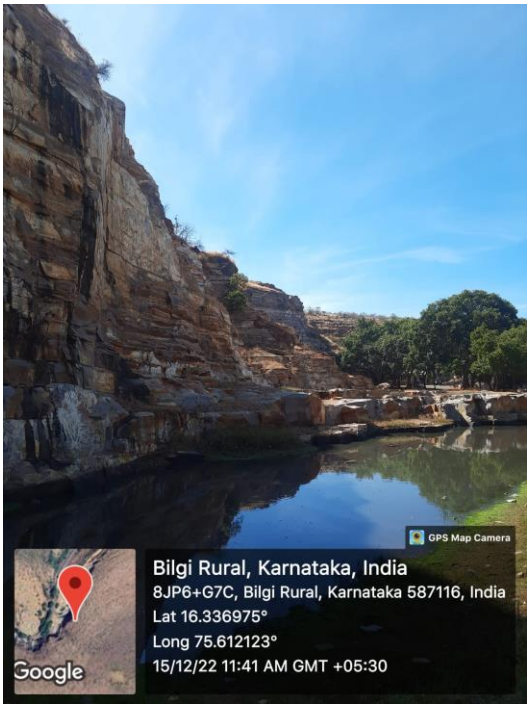
Weakly foliated granite porphyry of the ‘Clospet Granites’ are seen here which is a basement which is Overlain by Badami rocks. It is an igneous rock of equigranular texture. It had felsic acidic minerals like orthoclase, biotite and quartz. They are plutonic, phaneric, holocrystalline fine grained minerals. Closepet granites exhibit exfoliation joints, pegmatitic veins, scoop holes and weak foliations. The joints here were trending in the N261°.Veins of ‘Pegmatite’ intruding granite are hypabyssal rocks. They are phaneric and coarse grained. The width of the vein was about 4.5cm.The sheet joints seen are formed due to the release of pressure. Tors were present. Xenoliths were also present of size approximately 30cm. The composition of the xenolith is mafic, but less of hornblende. It is medium grained. Another xenolith present at the same spot which had a xenolith within a xenolith which could be of restitic type.

Xenolith within a xenolith

So we could conclude that at first there was formation of Granite which later got recrystallised then the basement Granite was intruded by pegmatite veins and further the development of jojnts that affected the pegmatite vein.

Spot 2: Quary opposite to Siddeshwar Temple (500 mtrs away from spot 1)
Lat N16˚33'72"
Long E75˚36’50’’
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.

Horizontal beds of sandstone



Spot 3 (around 11 kms away from spot 2)

Lat: 16°20'29"
Long: 75°36'58"

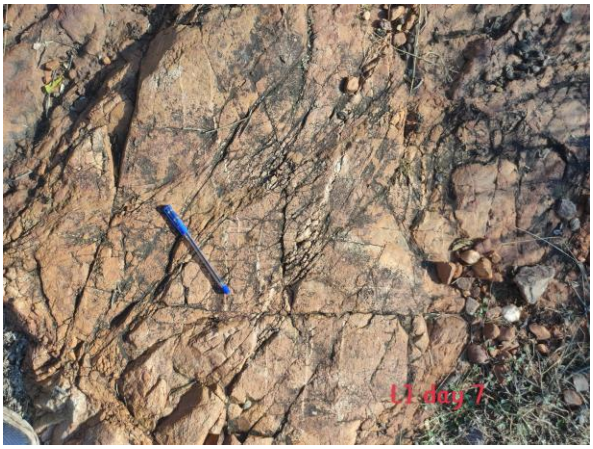
The outcrop here had intraformational conglomerate. The conglomerates had clasta which were of 4 cm in size and was made up of quartz. The rocks here have undergone cyclic decomposition. Syndepsitional primary structures were present. Some layers were pink and some were buff indicating presence of cross bedding structures. There were some normal graded bedding Conglomerates at some places. The bedding were striking N115° in the SW direction dipping by 11°.

Graded begging in conglomerate

13] Day VII
16/12/2022
Shirur

Spot 1
Lat: N16°05'47"
Long: 75°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 vein was different. The veins were coarse grained.

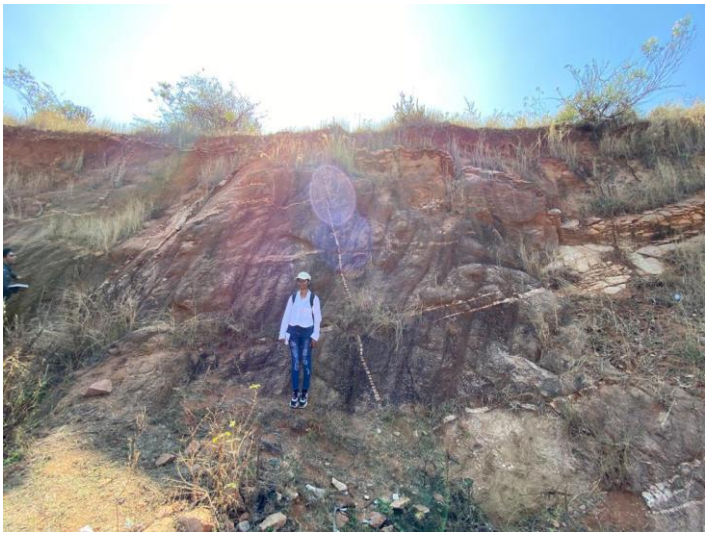


Highly fractured quartzite

Spot 2(around 50 mtrs away from spot 1)

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.

Quartz vein



Veins cross cutting each other

Spot 3 (Around 200 mtrs away from spot 2)
Lat:16°05'05"
Long:75°48'50"

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. Granite here was hornblende rich.

Pink granite

Spot 4 (Murdi)
Lat:N16°02'06"
Long: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.

White sandstone

Outcrop at spot 4

Spot 5(Niralkeri, approximately 5 kms away from spot 4)
Lat:N16°04'28"
Long: 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. The data is as follows.

Strike	Dip Amount	Dip direction
N85°	20°	NNW
N93°	23°	N
N103°	19°	S
N145°	23°	S

Outcrop of Ferruginous phyllite

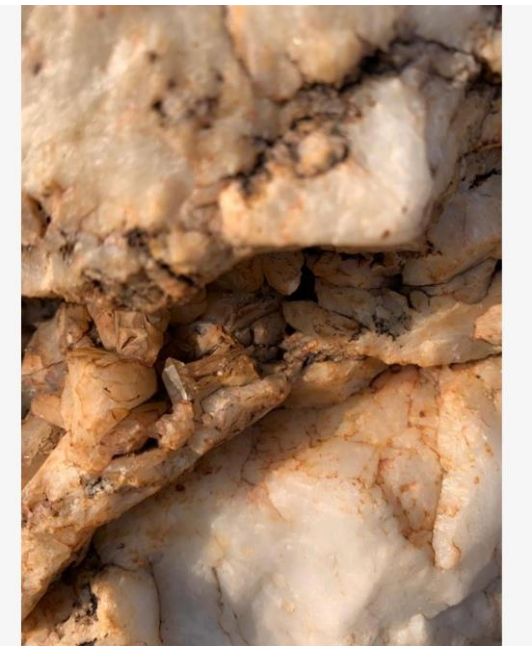
14] DAY VIII
17/12/2022
KAGALKOM

Spot 1 (20 kms away from Lodge)
Lat: N16°56'51"
Long: 75°38'24" E

Expansive outcrop of Quartzite was exposedexposed which was chemically weathered. Unconsolidated material of some minerals were observed. The outcrop was trending EW. The quartz here appeared white due to the presence of some Impurities. Very few hexagonal developed crystals were also seen. Extensive deformation has taken place at this outcrop. Radiating pattern of Quartz were observed. Quartz veins present which were trending in N69°. The ridge is trending in EW direction. Just few mtrs away Dolomite beds were also present. The data of the dolomite beds is as follows.

Strike	Dip Amount	Dip direction
N102°	40°	SSW
N104°	44°	SSW

Radiating pattern shown by quartz veins Quartz



Perfectly developed hexagonal crystals

Spot 2(Sulikeri Dolomite mine)
Lat:N16°8'39"
Long: 75°29'37E

At this mine Dolomite was mined and the trend was the same as spot 1 for dolomites.

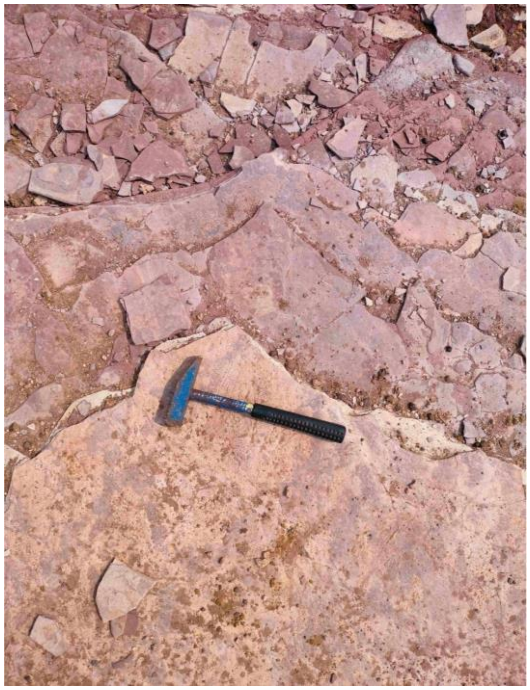
Dolomite mine

Spot 3(Konkankappa limestone under the bridge)
Lat:N16°1'14"
Long: 75°46'58" E
The exposed outcrop had Limestone which on pouring of HCl gave effervescence. They were sipping is SSW Direction. The data is as follows.

Strike direction	Amount of Dip	Dip Direction
N148°	5°	SSW
N132°	4°	SSW
N111°	2°	SSW
N94°	6°	SSW

Outcrop at spot 3

Spot 4
Lat:N16°1'14"
Long:75°46'58" E
The rock exposed here is Shale which is mesoproteeozoic in age. It is red in colour so it indicates that it is Ferruginous. It has bands of red and white colours. The beds were striking in N120° in SSE direction dipping by 6°.
Slaty cleavage in slate is at an angle to the Argillite bedding plane.



Ferruginous shale

Outcrop at spot 4

Spot 5 (Badami cave)
Lat:N15°56'18"
Long: 75°40'35" E
The unstratified chert breccia are overlain by westerly dipping sandstones of Badami Group- ‘Cave Temple Arenite’. They show clastic texture and are of siliceous and ferruginous matrix material. The sandstones of Badami Group are horizontally bedded and show various primary sedimentary structures. Other interesting feature to observe in these sandstones are soft sedimentary deformation features and liesegang bands. Microfaults are also seen.

15] DAY IX
18/12/2022
LOKAPUR

Spot 1 (Naganapur)
Lat:N16°10'14"
Long: 75°21'3"

The outcrop was expansive here and had foliation in rock. They were intercalated rock which were steeply dipping.
The rocks were striking in N121° in SE direction dipping by 75°.Limestone was present which had silicate bands of $CaCO_3$ so we could call this rock Marly Limestone. Deformed Stromatolites were also present. Stromatolites are used to date rocks. Layers of stromatolites were also trending in the same direction as the rock.

Deformed Stromatolites

Spot 2 (Jalikatti)
Lat:N16°09'33"
Long:75°28'58" E

At this spot there was a limestone mine which was trending in the N130°.

Limestone mine

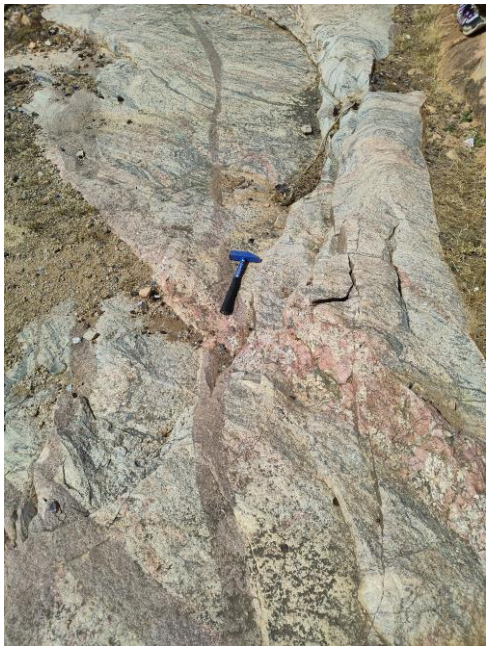
16] DAY X
19/12/2022

Spot 1 (Almatti dam)
Lat:16°33'10"N
Long:75°88'80" E

The Almatti Dam is a dam project on the Krishna River. The dam is located on the edge of Vijayapura and Bagalkot districts.The annual electric output of the dam is 713,000,000 kilowatts (KW). The height of the dam is 524 mtrs from MSL. The catchmemt area of the dam is 33,375 sq. km.180 villages have submerged due to the excessive water left out by the dam. The water of this dam is spread over 487 sq. Km.

Spot 2 (Vijayapur)
Lat: 16°29'28"
Long:75°55'33"

Migmatite was a basement here which is 3 billion years ago. The outcrop has undergone several episodes of melting producing different granites.Pegmatite Veins were present which were trending N306°. The oldest rock at this outcrop was Granite after which the pegmatite vein intruded after which Gneiss formed then the Banded Gneiss. The rocks here are all caught up. Joints were present which were trending N58°.



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