SCHOOL OF EARTH, OCEAN AND ATMOSPHERIC SCIENCES

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LABORATORY CERTIFICATE

This is to certify that ~~Mr.~~ /Ms. PRASHILA PRAKASH PEDNEKAR has satisfactorily completed the course of practical for M.Sc in Applied Geology.

Experiments conducted are pertaining to paper ----------

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GEOLOGICAL FIELD WORK REPORT IN AND AROUND BAGALKOT - KARNATAKA

By

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MSC PART 1

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ABSTRACT

The State of Karnataka constituted in 1956 includes the erstwhile princely states of Mysore, Coorg, Hyderabad and many tiny kingdoms situated within the geographic Boundaries outlined by the major dominions, besides parts of Madras and Bombay Presidencies. The state forms the west central part of Peninsular India between North Latitudes 11o 35'30" and 18o 25'30" and East Longitudes 74o 06'00" and 78o 35'30". It Occupies an area of 1,91,792 sq.km of which 1,86,792 sq.km are covered by hard rocks Consisting of crystallines and older sedimentaries and a narrow coastal strip of about 5,000 sq.km of Tertiary and Quaternary sediment

The state is drained by three major easterly flowing river systems. These are : (1) Manjira River of the Godavari basin in the north, (2) Krishna with its tributaries, Tungabhadra,

Ghataprabha, Malaprabha, Bhima and Vedavati draining the northern and Central part and (3)

Cauvery with its tributaries, Kabini, Hemavathi, Simsha and Arkavati Draining the southern part.

Most of the river courses are principally aligned in two directions: (1) ENE-WSW to WNW-ESE, (ii) north-south to NNW-SSE and correspond to the major lineaments, Faults, shear zones and joints. Many of the major rivers, particularly the west flowing Rivers and some sections of all the east flowing rivers.

The state experiencees humid Tropical to Semi – Arid climate for most part of the year.

The annual rainfall is about 300 to 500 cm in the coastal plains and the Western Ghats And about 80 cm on the eastern plateau. The Western Ghats are thickly forested. The Plateau is generally devoid of dense forest.

The work carried out was sampling the rock, measuring attitude and trend of the outcrops. All these observations were carried out to establish stratigraphic sequence of the field area, to deduce the geological history of the area, to recognise deformational structures and to classify the rocks present in the area.

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INTRODUCTION

Physiographic landforms of Karnataka

The state can be divided into four physiographic landforms – the Northern Karnataka Plateau, the Central Karnataka Plateau, the Southern Karnataka Plateau and the Coastal Karnataka Region

Northern Karnataka Plateau The Northern Karnataka Plateau covers the districts of Belgaum, Bidar, Bijapur and Gulbarga. The area is mainly composed of the Deccan Trap. It represents an extensive deforested plateau landscape. The Northern Karnataka Plateau has an elevation of 300 metres to 600 metres from the sea level. The plateau slopes towards the east.

The landscape is mainly covered with rich black cotton soils..

The vast expanse of treeless plateau is interspersed with river plains, watersheds, residual hills and ridges. The river plains are represented by those of River Bhima, River Ghataprabha, River Krishna and River Malaprabha. Central Karnataka Plateau

The Central Karnataka Plateau is located between the Northern Karnataka Plateau and the Southern Karnataka Plateau. It consists of districts like Bellary, Chikmagalur, Chitradurga, Dharwad, Raichur and Shimoga. The elevation of the Central Karnataka Plateau varies between 450 metres and 700 metres. The general slope of this plateau is towards the east. This region is the location of the Tungabhadra River basin.To Southern Karnataka Plateau .

The Southern Karnataka Plateau includes the districts of Bangalore Urban, Bangalore Rural, Hassan, Kodagu, Kolar, Mandya, Mysore and Tumkur. This plateau region is covered by a high degree of slope. It is encircled by the Western Ghats on the west and the south. TheSo arnataka Plateau has a general elevation of 600 metres to 900 metres. But the Biligirirangan hills of Mysore district and the Brahmagiri range of Kodagu district have residual heights ranging between 1,500 metres to 1,750 metrgranulit

Karnataka being a part of the ladian Shield is constituted of rock formations ranging in age from 1300 my 5 my

The state forms the west central part of Peninsular India between North Latitudes

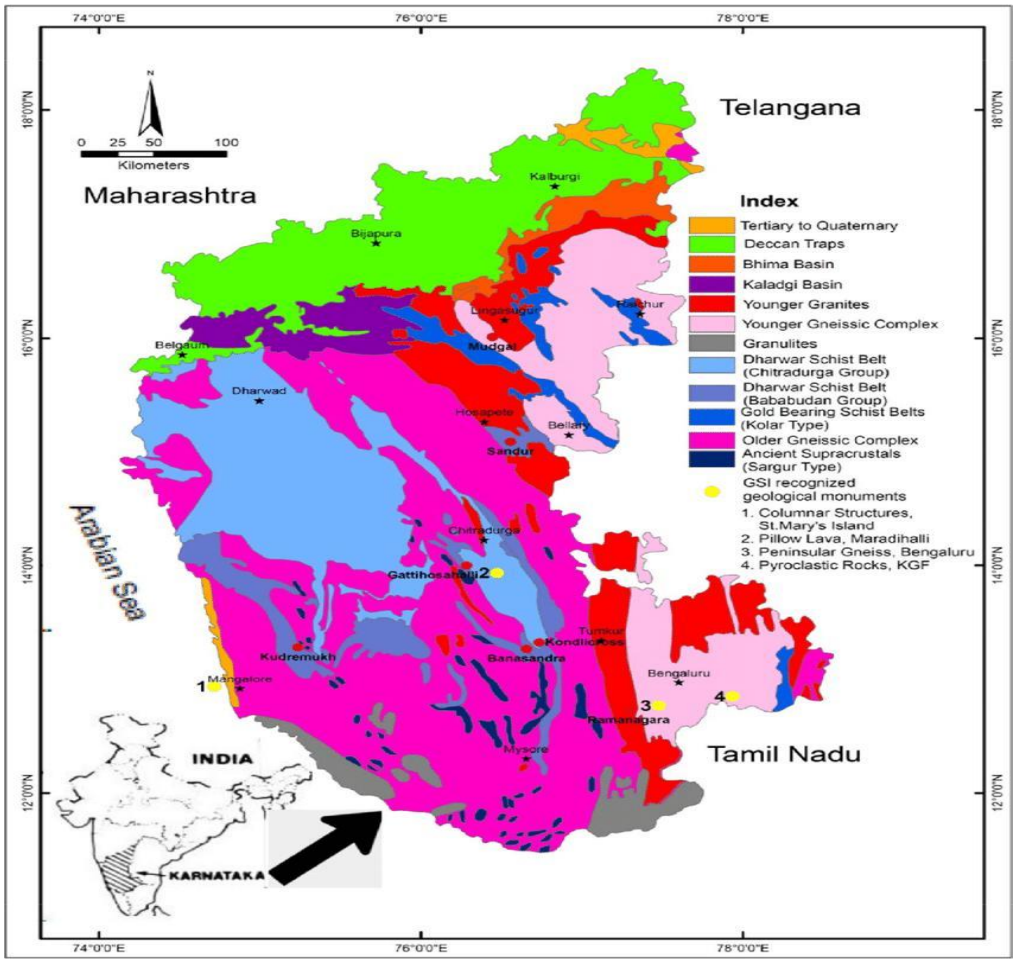


Fig 1: Geological map of Karnataka

11 3530" and 18 2530" and East Longitudes 74 06/00 and 78 3530" h occupies an area of 1, 91.792 km of which 1, 86,792 sq km are covered by hard rocks consisting of crystalline and older sedimentary and a narrow coastal strip of about 5,000 sq km of Tertiary and Quaternary sediments Barring a narrow coastal strip of about 5000 sq km of Tertiary and Quaternary sediments and another 31,250 km of Deccan basalts, the remaining area is dominated by Archaean- Proterozoic rocks. Mysore Plateau, geologically constituted of Dharwar Craton comprises of greenstone-granite belts, greisses and granulites.

Greenstone belts essentially consist of meta-volcano sedimentary sequences, surrounded and dissected by Peninsular Gneiss. At the southern end of the craton these give way to granulite suite of rocks. The craton

preserves a billion year orogenic history from 3400 m.a. to 2400 m.a.Epicratonic or intracratonic sedimentary basins called Purana Basins occupy the northern segment of the craton whose northern part in turn is concealed by Deccan basalts. Thus younging of litho sequence from south to north is evident in this region.

Regional Geology

The Kaladgi basin is located on the northern fringes of the Dharwar Craton of south India. The Kaladgi basin is exposed between the longitudes 73°E and 76°E and the latitudes of 15°30 N to 17° N. The contiguous exposures of these sediments, occurring in parts of the Belgaum, Bijapur and Bagalkot districts of Karnataka.

It is comparable to other Proterozoic 'Purana Basins of Peninsular India in its shallow marine, peri-cratonic sedimentary sequences. The kaladgi succession is >4500 mts resting on the Archean basement and covered by the Deccan traps. The basin is divided into the lower Bagalkot, belongs to meso-ptroterozoic and the upper Badami, which is Neoproterozoic in age. The two are separated by the angular unconformity. The Deccan Trap basaltic lava flows of Late Cretaceous-Early Paleocene age cover them across this region.

Kaladgi is the only Purana Basin that displays stronger deformation in its central parts than along the fringes. This deformation is restricted to the sedimentary succession of the Mesoproterozoic Bagalkot Group and is not observed in the younger Badami Group.

The basement for the Kaladgi sediments consists of crystalline and schistose rocks of Archean to Early Paleoproterozoic age. They are a typical cratonic assemblage comprising of granites and associated intrusive and the younger basic dykes intruding into multiple phases of greenstone belts and granitic gneisses. The Peninsular Gneisses are composed of tonalitic trondhjemiticgranodioritic (TTG) gneisses.The NNW-SSE trending Shimoga Schist belt is present to southwest of the basin (south of Belgaum), and its equivalents are recognised from the coastal belt around Malwan. This belt is composed of gneisses, conglomerates, phyllites and banded iron formations (ferruginous chert and quartzite). The NW-SE trending Hundgund-Kushtagi Schist Belt is a ~100 km long and 20 km wide belt that forms the basement in the eastern parts of the Kaladgi Basin, around Bagalkot. This tightly folded sequence of banded iron-quartzites, pelitic metasediments, interbedded basalts and minor ultramafies display multiple generations of folding. The folding and metamorphism of the Hundgund-Kushtagi schist belt is of Neoarchean age since it preceded the Neoarchean granitic intrusions

In the Bagalkot group the quartzitic sandstones and arkose at the base grade upwards into purple and brown argillites of the upper lokapur sucession.

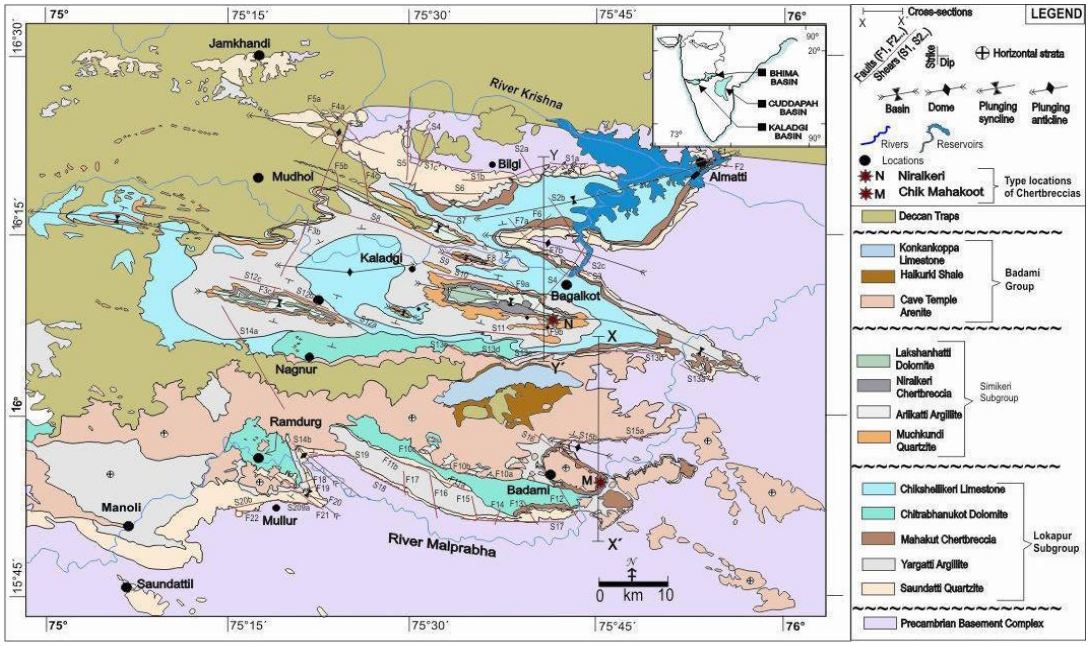


Fig 2: geological map of kaladgi basin

Overlying this are the cherty Stroferruginous dolomites. This are associated with siliceous ferrugeneous argillites which are shallow water deposits. Continued movement on faults generated chert breccia in the basal part Othe formation Limestones, dolomites and shales were deposited subsequently. Break in sedimentation is marked by a discomformable conglomerate. The overlying Simikeri succession consist of quartzite, chert breccia, ferruginous shale an dolomites. Towards the close of the bagalkot times pegmatite and quartz veins intruded the sediments.

DAY 1

Date : 10-12-2022

Spot : 1

Name of the place: karadiguddi

Latitude: 15°52’55”N Longitude: 74°41’40”E

An hill with moderate slope was exposed along the roadside which is extensively physically weathered . The rocks at the base of the hill were clastic in nature with clasts composition consisting of quartz and Jasper spheroidal grains. It is observed that the size of the clast of the conglomerate increases as one moves from down to up of the slope and also the grade from clast supported to the matrix supported increases towards upwards. Polymetic Conglomerate with siliceous matrixwas found, Conglomerate exhibiting graded bedding structure indicating it was deposited in the less periodicity deposition time . Rock identified here is Bevinmatti conglomerate At the upper part of the slope, Bevinmatti conglomerate is grading into the Muchkundi Quartzite of Kundargi Formation of the Simikeri Subgroup.Bevinmatti conglomerate.

Bevinmatti conglomerate marks the disconformity between the Lokapur Subgroup and the Simikeri subgroup of the Bagalkot Group of the kaladgi formation

Strike - 140°

Dip – 26° due NE

Spot : 2

Around 200 meters away from spot 1

Latitude: 15°52’37”N Longitude: 74”41’48”E

The rocks exposed here was texturally fine grain, equigranular, and holocrystalline, it has undergone spheroidal type of weathering and exhibits exfoliation this feature is formed due to right angle joints in rock . structurally it’s an vesicular rock but very small amount of the vesicles are filled by the secondary mineral zeolites and shows Amygdaloidal structure. Rock identified is basalt . Colour index is Melanocratic. It’s a part of basaltic lava flows of the Deccan traps of Sahyadri group of cretaceous-Eocene age. (Kale, 2020). At this site the Basalts are surrounded by the older rock beds i.e. Deccan traps are being surrounded by the kaladgi basin forming the outlier structure. It has undergone intense weathering and rock can be easily broken .

Fig 3 : Spheroidal weathering in basalt

DAY 2

DATE : 11-12-2022

Spot : 1

Location: Ramthal , at the bank of Malaprabha river

Latitude : 15°52'37"N Longitude: 74°41'48"E

Ramthal is situated at a distance of 25km from Bagalkot along the bank of Malaprabha river. The rocks are exposed over a hill with the moderate slope and has been physically weathered. Rocks are texturally banded with the light and dark coloured bands. Minerallogically dark coloured bands are of hematite and the light coloured bands are of quarzitic and of jasper. These are Banded hematite Quartzite and Banded Hematite Jasper. These BHQ and BHJ are highly folded and highly metamorphosed and belongs to the NWSE trending Hundgund-Kushtagi schist belt. BHQ shows intrafollial folds which indicates 2 events of folding, axial plane of 1 fold generation is parallel to axial plane of 2nd fold generation.

They forms the part of the basement rock of the kaladgi basin, rocks shows layering and cross bedding. At the base of the hill insitu rock is not exposed, many exsitu rocks can be found. The phyllites here are intensely weathered and can be easily broken into small chips. This is derived from the gneisses belonging to Hungund schist belt. The beds are highly folded . deformation has taken place and hence this are basement rocks which are older. Chert and Hematite are also observed wherein the quartz is highly compatible. Has by taking the structural data it is observed that this fold is a asymmetrical plunging fold. As we traverse upwards we encounter folded BHQ's that shows class 1C fold with the thickness of the hinge is more than the thickness of the limbs.

Readings taken on the folliated arms of phyllite

1) **Strike :N 161°**

   Dip : 38° due SW

2) **Strike : N133°**

   Dip : 76°due SW

3) **Strike:N 148°**

   Dip : 20° due NE

Reading close to hinge

4) **Strike:N 155°**

Dip : 40° due SW

Fig 4 : folding in BHQ and cross bedding in Quartzite

Spot : 2

Location: Caliche - roadcut section

Latitude-N 16°45’ 9” Longitude- E 75°52′29.9”

Around 25-30 meter size width white exposure was seen along roadside , rock was very soft to touch with low hardness, On this location we observed the leached calcium carbonate known as Caliche. This was confirmed by applying HCL on the rock which gave out effervesence . This has formed by leaching of calcium rocks. It is the weathered part of limestone. They are carbonate formations formed in semi-arid region the caliche is generally light in colour cemented together with material like gravel, sand, clay, silt and other minerals . Here Smokey quartz with vitreous lustre was seen along calcite

Fig 5 : Caliche deposit

Spot : 3

Location : ramthal road cut section

Latitude: N 16°42’6 ” Longitude- E 75°51′27”

The lithology observed in this area was alternating bands of BHQ and phyllite . Warping in the layers of fold can be seen with intrafollial folds with steep folded layers and we’ll exposed hinges .

Readings taken on the limbs of the fold

1) **Strike : N40°**

   Dip-34" towards NW

2) **Strike : N306°**

   Dip-40 towards NE

3) **Strike: N320°**

   Dip- 74 due NE

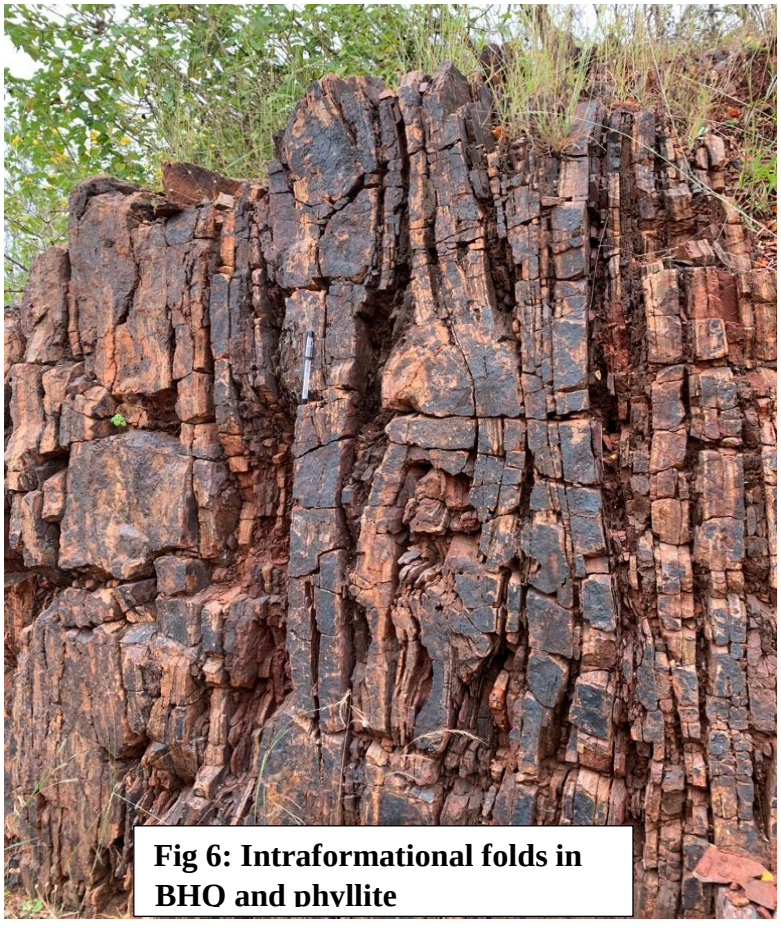


Fig 6: Intraformational folds in BHQ and phyllite

Spot : 4

Latitude: N 16°42’6 ” Longitude- E 75°51′27”

Location 4 is next to the location 3 , where one can see competency between competent and incompetent layers with shallow plunge , there are folds with microfolds . There are 2 events of folding observed wherein Sn is parallel to axial plane and SN+1 is the intrafollial fabric. This region marks the unconformity between hundgund schists belt and salgundi conglomerate.

Readings taken along limbs of fold (phyllite+ BHQ layers)

1) **Strike : N334°**

   Dip : 76° due NE

2) **Strike : N325°**

   Dip : 65° due NE

3) **Strike : N326°**

   Dip: 80 due NE

4) **Strike : N332°**

   Dip : 86 due NE

5) **Strike : N338°**

   Dip. : 80° due SW

Plunge of the fold axis : 34°

Trend of the fold axis: 320° due NW

DAY : 3

DATE : 12-12-2022

Spot : 1

Location: Nargund, base of nargund hill

Latitude:.N 15°46'7" Longitude:E 75°21'51"

As we approached the base of the hill we could prominently see the small scale horizontal shear zone within the shear zone the alignment of minerals is parallel to folliation , rock identified here was metamorphosed phyllite intercalated with BHQ . Numerous quartz veins were also found parallel to folliation which were likely intruded at the time of formation of Folliation but are of younger age, as the rock was deforming veins were simultaneously also getting intruded thus were directed in the direction of Folliation.

Folliation shows warping which is the reason for varying dips of fold limbs present there.

Dip varies between 4° whereas strike remains the same .

Next to the warping sinistral shear indicators were observed due to which 3 deformation fabrics could be observed wherein Sn-1 is not visible, SN+1 shows 3 – 4 meter long exposure and SN fabric could be seen within it . This phyllite has the same structural data as found at Ramthal (spot 1) which indicates it is the continued part of the same phyllite.

Structural data taken on the limbs of fold

1) **Strike : N150° Dip : 76° due SW**
2) **Strike : N152°**

   Dip : 79° due SW
3) **Strike : N160° Dip : 76° due SW**
4) **Strike : N160°**

   Dip : 76° due SW

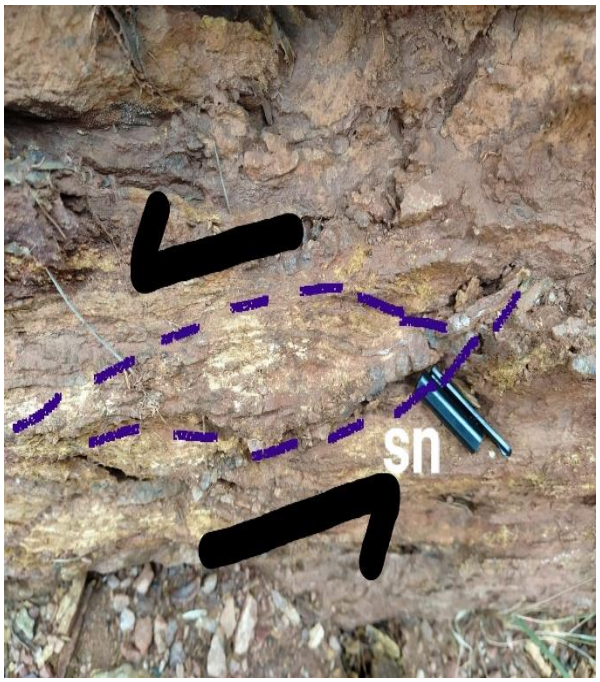


Fig 7: sn , sn+1 & sn+2 fabric in phyllite

Spot : 2

Location: next to spot 1

Latitude:N 15°46'7" Longitude:E 75°21'51"

Spot 2 at 8-10 meters distant from spot 1 . Here 2 giant quartz veins were seen intruding along folliation plane .

Structural data taken on the plane (phyllite)

1) Strike : N145°

Dip : 65° due S

Structural data taken on on quartz veins

Strike : N150°

Dip : 84° due SW

Strike : N150°

Dip : 46° due SW

Spot : 3

Location: next to spot 2

At this site, there is an angular unconformity present which seems to be of recent age, at the base there are steeply diping vertical planes with quartz veins which are vertical or parallel to planes and then turns inclined at the head upward towards the hill . Steeply diping planes are overlain by horizontal layer of loosely packed soil over which lies bed of cobble and pebble size clasts which are loosely held and can be easily plucked out this indicates it's an recent deposition also structural features such as reverse bedding can be seen

This formation doesn't belong to Kaladgi Supergroup which is proterozoic in age

Structural data taken on steeply diping planes

1) **Strike : N150°**

   Dip : 84° due SW

2) **Strike : N130°**

   Dip : 65° due SW

3) **Strike : N145°**

   Dip : 65° due SW

4) **Strike : N150°**

   Dip : 46° due SW

Fig 8: angular unconformity

Spot : 4

Location : peak of the nargund hill

Latitude:N 15°43’49” longitude:E 75°22’46”

This site is located at the summit of the nargund hill where bhoruka power plant corporation limited is set up , exposure of the outcrop is massive, rock identified is ferruginous Quartzite which is highly fractured and jointed. Numerous orthogonal and conjugate joints could be seen whereas at many places cross bedding could be observed.

Also at the south of the exposure herringbone structure was seen which is formed during Sedimentary processes

This exposure is an outlier.

Structural data taken on orthogonal joint set

N225°

N226°

N252°

Structural data taken on conjugate joint set

N250°

N161°

Fig 9: saundatti Quartzite

DAY : 4

DATE : 13-12-2022

Spot: 1

Location – Aihole Village

Latitude: N16°0’48” Longitude:E 75°53’5”

The exposure is exposed along western side of the road , rocks here dips aong SW , Beds have undergone weathering and erosion, colour of the rock is pink and red , it is an expansive outcrop with cross bedding structure well preserved in rocks with bands of red and white minerals which is identified as alternating banding between siliceous and ferruginous material. Rock identified here is Quartzite with intraformational conglomerate having clasts of Jasper, milky quartz, feldspar and some dark colour minerals, clast size ranging from 7 – 10 -12 cm .

Here basal conglomerate marks the unconformity which lies t the base between Bagalkot and badami formation , these basal conglomerate are intraformational within bedding junction, we could identify 6-7 layers spreading horizontally one above other .

Structural data taken on bedding planes

1) **Strike : N115° Dip : 38° due SW**
2) **Strike : N132°**

   Dip : 36° due SW
3) **Strike : N116°**

   Dip : 37° due SW

Fig 10: intraformational conglomerate beds with Quartzite

Spot : 2

Location: 20 meters away from spot 1 due east

Latitude:N 16°0’48” Longitude E 75°53’5”

The exposure exposed here is subhorizontal having a small dip of amount 87° , it is an massive exposure. rock identified here is siliceous sandstone whereas at some places ferrugenous sandstone could be seen due to reddish colour with alternate banding. Rock is highly weathred, at some spots rock shows folliation where it can be broken easily with hammer. Also small micro folding was observed.

This formation forms the base of badami formation which is underlain by basal intraformational conglomerate and Bagalkot formation.

Spot 3

Location: shirur , next to the temple.

Latitude: N16°5’34” Longitude:E 75°46’57”

An expansive outcrop of quartzite is exposed along the left side of the temple , One can identify that it is an fault plane based on surface striations and surface lineation present there although there is no offset marker or shear stress indicator inorder to know which plane has moved up or down . At some spots small slickensides were seen along which precipitation of secondary mineral was observed this plane is shallow dipping, many orthogonal and conjugate joint sets were observed on the plane which indicates brittle deformation .

Using Anderson’s theory of faulting we can conclude it is an reverse fault as it makes an an angle of < 30°

Structural data taken on plane

1) Strike: N111°

Dip : 60° due N

Orthogonal Joint sets data

1) 148° N

150°N

Fig 11: En-echelon joints in Quartzite

Fig 12: slickensides

DAY : 5

DATE : 14-12-2022

Spot: 1

Location: Amingad hill , base of the temple

Latitude: N16°3’30” Longitude: E75°56’54”

At Amingad , at the base of the hill large insitu undeformed boulders of the pink granite is found having orthoclase feldspar, quartz and hornblende . Texturally coarse grained , holocrystalline and leucocratic colour index . It is an closepet granite exposed in the basin of kaladgi age back to 3.5Ga . It consists of coagnate xenolith . Size of the xenolith is 7-12 cm , it shows folliation , subrounded / ovulate in patches form .

Fig 13: pink granite

Spot : 2

Location: Amingad hill (near temple beside holy neem tree)

Latitude:N 16°3’32” Longitude: E 75°56’5

Spot 2 is at 40-50 meters away from spot 1 near the neem tree as we move upward the hill towards temple. It was observed here that rock on the NE side has undergone intense weathering compared to rock on the NW side . Alignment of minerals was seen with joint sets which indicates rock has undergone deformation and there is presence of shear zone .

The trend of the joints observed here is N145° which is similar to that of hundgund schists belt infering we are at the basement rock , schistosity seen in this rock is low .

Fig 14: joints

Spot : 3

Location: behind Adarsha mahavidyalaya high school .

Here the rock exposed behind adarsh mahavidyalaya , it shows high content of iron in BHQ as compared to that of Ramthal. Here folding is observed in BHQ, quartz vein is cross cutting across it infering it is younger than surrounding rock , folds in BHQ are not tight whereas phyllite shows tight folds .We observed Rocks which are older then the sedimen tary socks of the Koladgi Baxin. Here we have intrafolial domain or lenses that is preserving early Structures in the Rock overprinted by the very penetrative fabric which is having strike 125°N and the dip Is 55° due N. The beds are shallow dipping at the base of the hillock and steeply diping or becomes nearly vertical as we move upward. They preserve the structure of basement without getting affected by later deformation. Here curving belt parts of basement are the Remaining like lenges which are not taking part in defrormation known as Shear lenses.

Structural data taken on phyllite beds

1) **Strike : N130°**

   Dip : 65° due NE

2) **Strike : N339°**

   Dip : 59° due N

3) **Strike : N310°**

   Dip : 90° due NE

Structural data taken on fold hinge

1) Strike: N142°

Dip : 85° due NNE

Fig 15: Hundgund schists belt

DAY : 6

DATE : 15-12-2022

Spot : 1

Location: Bilgi

Latitude:N 16°20’25” Longitude:E 75°36’42”

There is a large exposure of grey and pink granite together, at some patches one can prominently see pink granite whereas at some places it shows grey granite having biotite as accessory mineral . Granite is crystallised , leucocratic felsic igneous rock with coarse grained crystallised pegmatitic veins of variable widths ranging from 7-10 cm to 30 cm in width trending due SE – NW having > 70% of orthoclase feldspar. In the eastern side of the exposure granite has undergone recrystallisation . This recrystalised and deformed granite is older in age on which younger intrusion of pegmatitic veins,. Joints and minute dextral faulting shear sense is observed. Weathering patterns such as exfoliation, and joints were seen all over outcrop.

Also many joints could be readily observed on the surface, trend of the joint is N86°. Also xenoliths were found along granie of size 20-30 cm , oval shaped trending 72° N . Composition wise it consists of hornblende, quartz, feldspar and biotite. At first and second place xenolith found was restite xenolith it consists of lots of quartz from surrounding Granitic rock , appeared dark in colour , quartz is weathered and can be scratched with knief . At third place xenolith found was accidental/ Exotic xenolith where one xenolith was found inside another xenolith. And it showed folliation.

Stratigraphically they form the basement rocks of badami group which is overlain by conglomerate.

Trend of the Pegmatitic veins

1) **N55°**
2) **N50°**
3) **N62°**

Trend of xenolith

1) **N72°**

Fig 16: Restite xenolith

Fig 17: accidental / Exotic xenolith

Spot : 2

Location: Quartzite quarry Bilgi

This spot is around 200 meters away from spot 1 opposite to Siddheshwar devasthan . The study area is a quarry of quartzite and shows a sharp contact between sandstones and Quartzites. Different types of colour banding can be seen due to weathering, erosion and leaching processes by water. The quartzite is in the shape of blocks. The thickness of the bed is ~75cm. This Quartzite has an base of closepet granite. The structural data recorded here is as follows

1) **Strike: N88°**

   Dip : 11° due NS

2) **Strike: N114° Dip : 6° due NS**

3) **Strike: N110°**

   Dip : 3° due NS

Fig 18: quartzite quarry

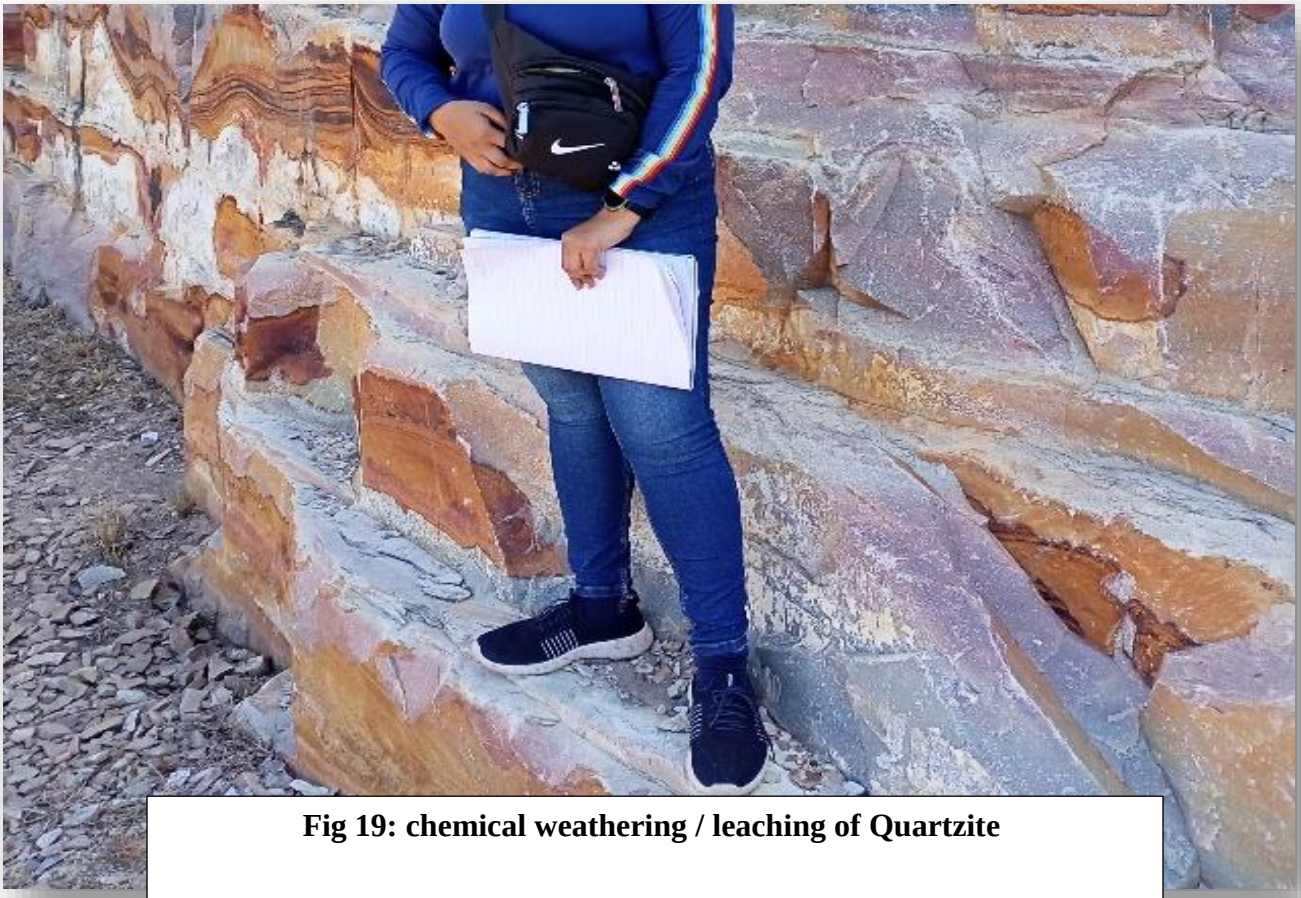


Fig 19: chemical weathering / leaching of Quartzite

Spot : 3

Location: Rural bilgi , near temple Latitude:

Longitude:N 16°20’43 longitude:E 75°37’11”

Outcrop at this spot is hillock with gentle slope where beds are nearly horizontal and shows syndepositional structure such as cross bedding, graded bedding which is prominently observed along outcrop which is formed due to variation in deposition velocity. Conglomerate observed here is oligometic type having clasts of quartz and feldspar, clast size is 7-9 cm , it is an intraformational conglomerate .

This formation is younger than the Quartzite quarry observed at spot 2 .

Structural data taken on intraformational conglomerate beds

1) Strike : N115°

Dip : 11° due SW

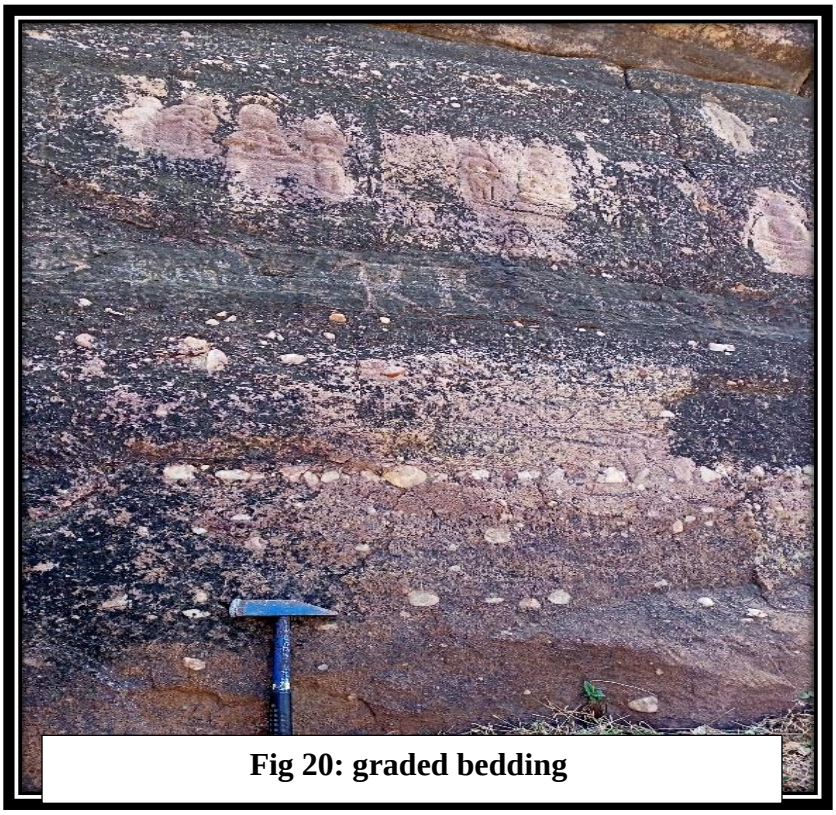


Fig 20: graded bedding

DAY : 7

DATE : 16-12-2022

Spot : 1

Location: national highway 367 , budangad Karnataka

Latitude:N 16°5'47" Longitude:E 75°48'7"

A widely spread outcrop of quartzite is exposed along NW of the road trending NW – SE .rock is highly fractured and shows massive joint sets they are of two types one is parallel to bedding and other is perpendicular to bedding . It is not possible to infer about any offset here because hardly few joints are extending over large area (throughout exposure) while some are extending at shorter distance upto 2-3 meters. With these features few coarsely crystallised milky white quartz veins were encountered of thickness 5-

7 cm . quartz appeared as comb like structure, growth of minerals is perpendicular to vein wall , such structure is known as comb structure. These veins basically formed as due to faulting because of which fluids travel between spaces and gets crystallised there after which when 2 blocks move apart due to external or internal forces , thus the minerals grows perpendicular to the wall such that 2 grains gros criss cross intro each other such veins are called as Gash veins .

Structural data taken on quartz veins:

Trend of veins 1) N49° 2) N52

Fig 21: joints in Quartzite and gash veins

Spot : 2

Location : national highway 367 , budangad Karnataka

Latitude: N16°5'10" Longitude:E 75°48'48"

This location is around 1 – 1.2 km away from spot 1. Where coarse grained hornblende rich granite was seen which showed folliation. Outcrop is weathered. Perpendicular to folliation plane coarse grained quartz veins were intruded which are of different age but all are younger to folliation. Width of the veins is 10-12 cm while some were 5-7 cm , they are found throughout the exposure while some veins are metamorphosed . Further away pegmatite vein was found intruding a boulder that was comparatively Thicker than the others. As we move along the hill, the rock has feldspar, quartz. But the Percentage of feldspar has increased as compared to quartz. The large phenocrysts of felspars Can be seen. Hence it is called as porphyry syenite.

Structural data – trend of vein

1) **N275°**
2) **N60°**
3) **N189°**

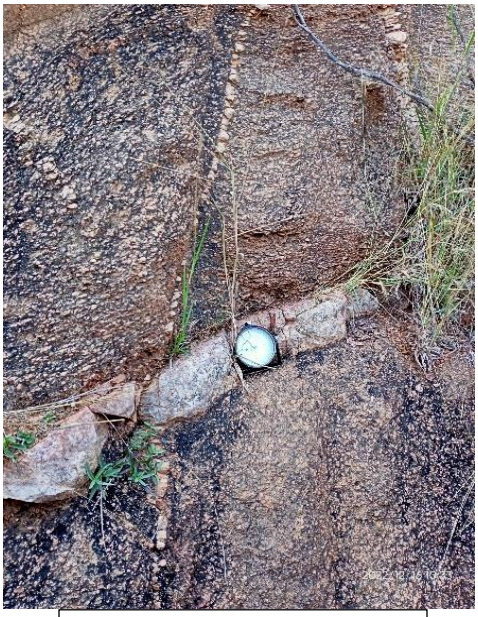


Fig 22: quartz vein

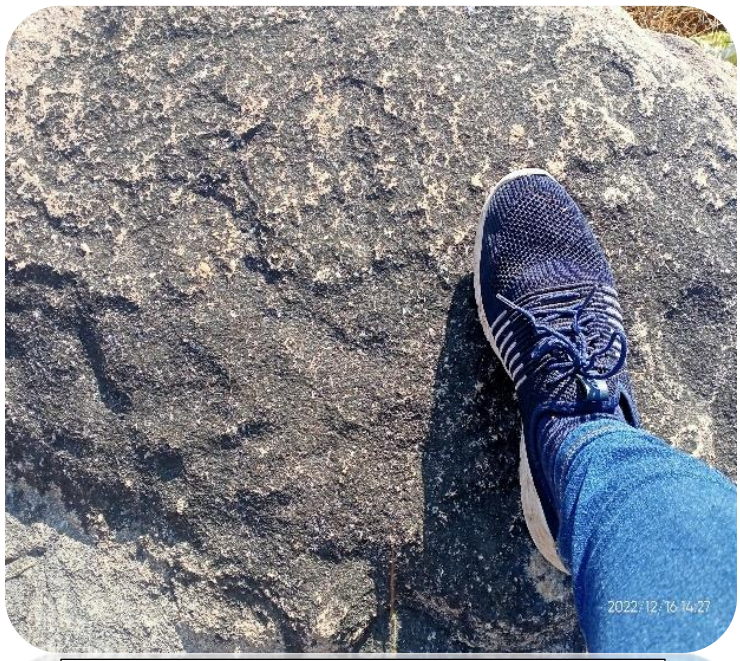
Fig 23: cross cutting relationship of quartz veins

Spot : 3

Location: Murudi

Latitude:. N 16°2’6” Longitude:E 75°45’26”

The expansive outcrop of quartzite is exposed at this place, rock is fractured and intensely weathred. It shows two types of prominent jointing i.e orthogonal and conjugate joints. Outcrop also shows cross bedding and hearing bone structure, Quartzite also has clasts in it which are of Jasper, quartz, some amorphous variety of minerals and feldspar. There were two types of Quartzite which were observed they are silicious and ferruginous which were slightly reddish in colour. This Quartzite belong to saundatti formation.



WFig 24: wethered surface of Quartzite

Fig 25: quartzite quarry

Spot : 4

Location: Rajyogi road kelawadi Karnataka

A small exposure of phylliitic folded layers were exposed along the road cut section of

Rajyogi road. Rock identified here was phyllite

Structural data taken on limbs and hinge of fold

1) **Strike: N95°**

   Dip : 35° due S

2) **Strike: N81°**

   Dip : 26° due NNW

3) **Strike : N145°**

   Dip : 23° due S

4) **Strike : N103°**

   Dip : 19° due S

5) **Strike : N105°**

   Dip : 10° due N

6) **Strike : N85°**

   Dip : 20° due N

Fig 26: folded phylliitic layers (syncline fold)

Spot : 5

Location: Niralakeri Dolomite mine , kamatagi Karnataka

Latitude:N 16°7’3” Longitude:E 75°41’55”

This is a dolomite mine (KSMCL – Karnataka state mineral corporation limited) the dimensions of the benches is width 5-6 meters and and height 5-6 meters.

Fig 27: dolomite mine

DAY : 8

DATE : 17-12-2022

Spot : 1

Location: Hubli vijayapur – gulbarg road hoolageri kagalkomb Karnataka

Latitude: N16°6’51” Longitude:E 75°38’23”

This location consist of steeply diping dolomite beds at the roadside which at a distance of about 200 – 220 meters in the uphill Direction has intrusion of huge quartz vein trending due E – W , having width of 8-10 meters, chemically weathered and highly fractured. 3 varieties of quartz were seen here they are clear quartz, milky white quartz and amorphous form . Tensional cracks were seen which are perpendicular to extensional cracks which have formed due to deformation, within these cracks with time due to formation of void spaces a new mineral will crystallise .

Some quartz crystals found here were fully euhedral crystals while some crystals have fused boundaries while others are amorphous, features such as gush veins of quartz , geodes , euhedral crystals or quartz were prominently seen .

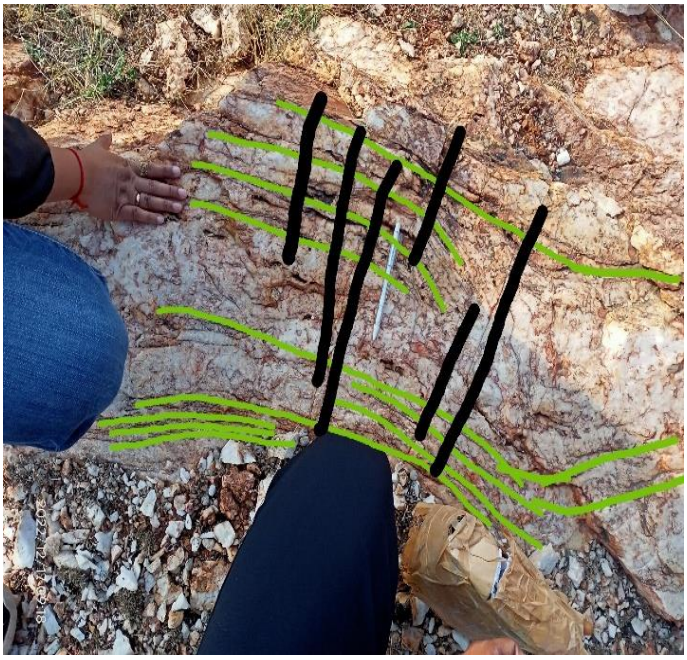


Fig 28 : green lines indicate extensional cracks while black indicates

Fig 29: highly fractured quartz and gash veins in quartz body

Spot : 2

Location: Hubli vijayapur – gulbarg road hoolageri kagalkomb Karnataka

Latitude:N 16°6’51” Longitude:E 75°38’23”

This location is just next to the location 1 , here the steeply diping dolomite beds are exposed over which quartz vein was introduded as mentioned in location 1 description. It is an expansive outcrop, rock identified as dolomite by applying HCL on the surface which produced effervesence , Texturally rock is fine grained with minute colourless fused crystals , colour of the rock is buff / grey , it has undergone weathering and erosion.

Structural data taken on the steeply diping planes

1) **Strike : N95°**

   Dip : 55° due S

2) **Strike : N105°**

   Dip : 53° due S

3) **Strike : N106° Dip : 54° due S**

4) **Strike: N114°**

   Dip : 45° due S

5) **Strike : N105°**

   Dip : 44° due S

Spot : 3

Location: Hubli vijayapur – gulbarg road hoolageri kagalkomb Karnataka

Latitude:N 16°6’33” Longitude:E 75°38’47”

This location is a dolomite mine .

Spot : 4

Location : kokankoppa limestone

Latitude:N 16°3’18” Longitude:E 75°38’45”

This outcrop is exposed along roadside near small flowing river where the rock exposed is grey – white in colour, minerals are very fine grained and shows folliation . Bedrock strikes N81° and dip 4° due N. On applying HCL it produced effervesence.

This is the kokankoppa limestone formation of badami subgroup of Kaladgi Supergroup. .

Structural data taken on the folliation plane of limestone

1) **Strike : N148° Dip : 5° due SSW**
2) **Strike : N132°**

   Dip : 4° due SSW
3) **Strike : N111 ° Dip : 2° due SSW**
4) **Strike : N94°**

   Dip : 6° due SSW
5) **Strike : N114° Dip : 6° due SSW**
6) **Strike : N125°**

   Dip : 6° due SSW

Spot 5:

Location: Halkurki shale Bagalkot

Latitude:N 16°1’14” Longitude:E 75°38’58”

Halkurki shale belongs to the badami subgroup of Kaladgi Supergroup, Halkurki shale is overlain by the kokankoppa limestone which is younger Sedimentary formation. This is a widely spread outcrop of ferruginous (reddish – brown colour) shale with lamination of dark and light colour bands these laminations forms the bedding planes. Mineralogy of the shale cannot be predicted with hand specimens as it is formed through clay minerals which can be montmorillonite , chlorite, vermiculite, kaolinite , smektite etc .

Age of this basin is Neoproterozoic , Halkurki shale is also called as argillite.

Structural data taken on bedding planes

1) Strike: N154 Dip : 6° due SSE

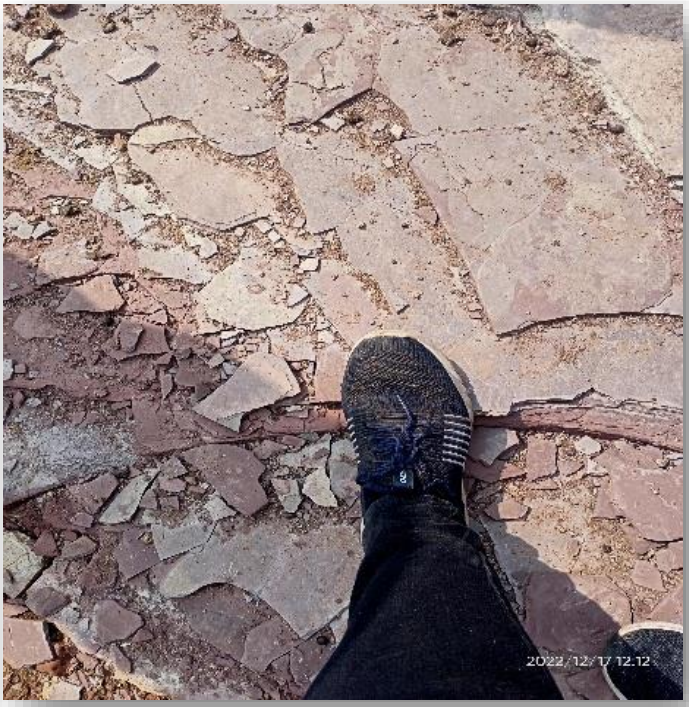


Fig 30: Halkurki shale

Spot : 6

Location: badami caves

Latitude:N 15°56’18” Longitude:E 75°40’35”

Badami formation is made dominantly up of sandstone. These monuments are made up of Neoproterozoic age (900-800 million year old) sandstones. These sandstones formed mostly in a large braided river system that flowed in a northwesterly direction.

Between roughly 1800 -800 million years ago, the Indian continental crust sagged due to various tectonic forces to form several long lasting sedimentary basins. The Kaladgi Basin in which the Badami area sandstones were deposited is one such basin. .Much of this deposition took place in inland or epeiric seas that flooded the Indian continent. During intervals of sea level fall, rivers carved valleys and deposited coarse sediment. The Badami Cave sandstones are river deposits of the Kaladgi Basin.The Badami braided river system was receiving sediment eroded from Archean age (>2.5 billion year old) rocks situated SE of the basin. These were granites, granodiorites, and low to medium grade metamorphic rocks of the Dharwar craton. Cross bedding structure can be seen prominently on the carved caves walls

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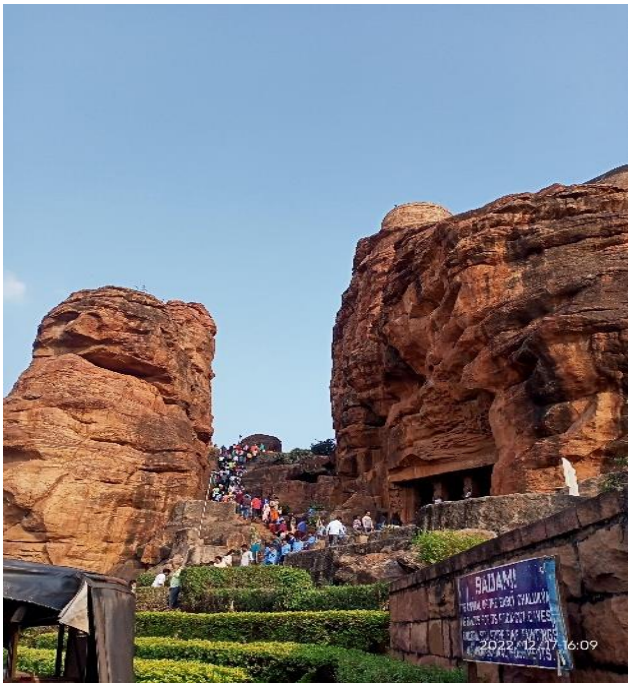

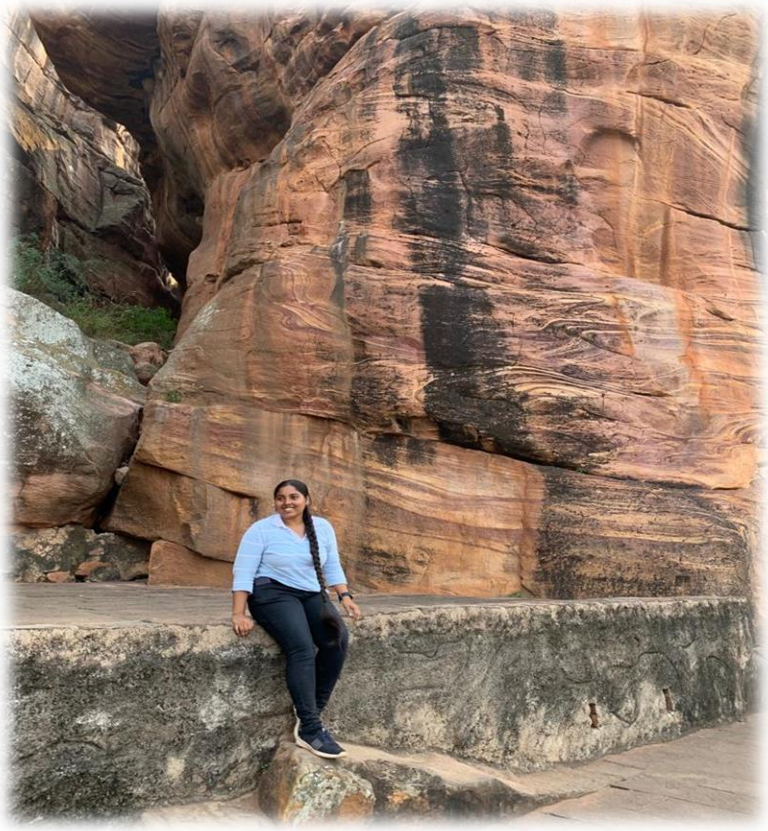

Fig 32: Preserved cross bedding in badami sandstone caves

DAY : 9

DATE : 18-12-2022

Spot : 1

Location: Nagnapur Karnataka

Latitude: N16°10’4” longitude:E 75°21’31”

The widely spread outcrop of stromatolites intercalated with Marl (muddy) limestone is exposed along the south of the main road. Age of this formation belongs to mesoproterozoic time . Beds are trending due EW . Stromatolites are organo s- Sedimentary structure formed by blue green algae. colonies of stromatolites are flower like structures found along layers but here they are identical due to high deformation within rock. Prominently seen variation in types of stromatolites were very deformed once, secondly some were in the form of pink bands (lamellar form , elongated bands) while third one was an eye like structure.

Stromatolites are deposited as soon as rock is deposited, they starts growing on them again the deposition of sediments takes place thus the previous layer of stromatolite gets trapped and preserved . These stromatolites are used for dating of kaladgi basin based on the type of stromatolites found

Limestone here had small fractures into which calcite is seen .

There is a quarry behind in the south direction of the exposure.

Fig 32: deformed and irregular stromatolites

Spot : 2

Location: jalikatti dolomite mine

At this location limestone mine was seen where fully crystallised calcite crystals were found, lithology was soft along benches.

33: Fully crystallised calcite

DAY : 10

DATE : 19-12-2022

Spot : 1

Location: Almatti dam bijapur

Almatti dam is built across Krishna river , it contributes to 60% of irrigation in Karnataka, it is an mixed type of dam also known as earthern embacment dam and the basement rock for this dam is Quartzite . Dam consist of 6 turbines and 6 control gates. In catchment area the water is collected from Mahabaleshwar. And the total area of water store body is 487 sqkm . This dam is also declared as bird sanctuary as the birds from different parts of the countries comes here seasonally.

S.G Bedetundri first identified this spot as an ideal place for dam building. Almatti dam is also known as lal bahadur shastri dam , it was inaugurated by Dr . APJ Abdul kalam in 2006 . Due to building of this dam 180 villages have submerged due to which more than

2000 families have been rehabilitated , as a result new city has been made named as

Navanagar after Bagalkot.

Spot : 2

Location : vijayapura national highway

Latitude:N 16°20’28” Longitude:E 75°55’34”

The outcrop exposed here if of Migmatite , it serves as an basement rock of age 3.2 – 3.5 Ga which is as same as age of TTG .

Here one can see the massive exposure of Migmatite spreading around 1km at the roadside which consists of gneisses, pink granite, grey granite, pegmatitic veins and old black peridotitic rock . The peridotitic rock is crushed into pieces due to deformation . Also slight offsets such as faulting could be seen. It is difficult to infer deformation history physically just by looking at the outcrop, with the naked eye only 6 can be identified. The detailed study can be done by dating the rock . It can be stated that the coarse grained Pegmatite vein is the youngest under which lies the pink granite, grey granite, white granite, banded gneiss and the oldest rock is peridotite. This inference is made by observing the cross cutting relationship between pegmatite vein , pink granite and grey granite.

Fig 35: Migmatite

Fig 36: Plotting the location map inorder to locate ourselves using lat longs taken in the field .

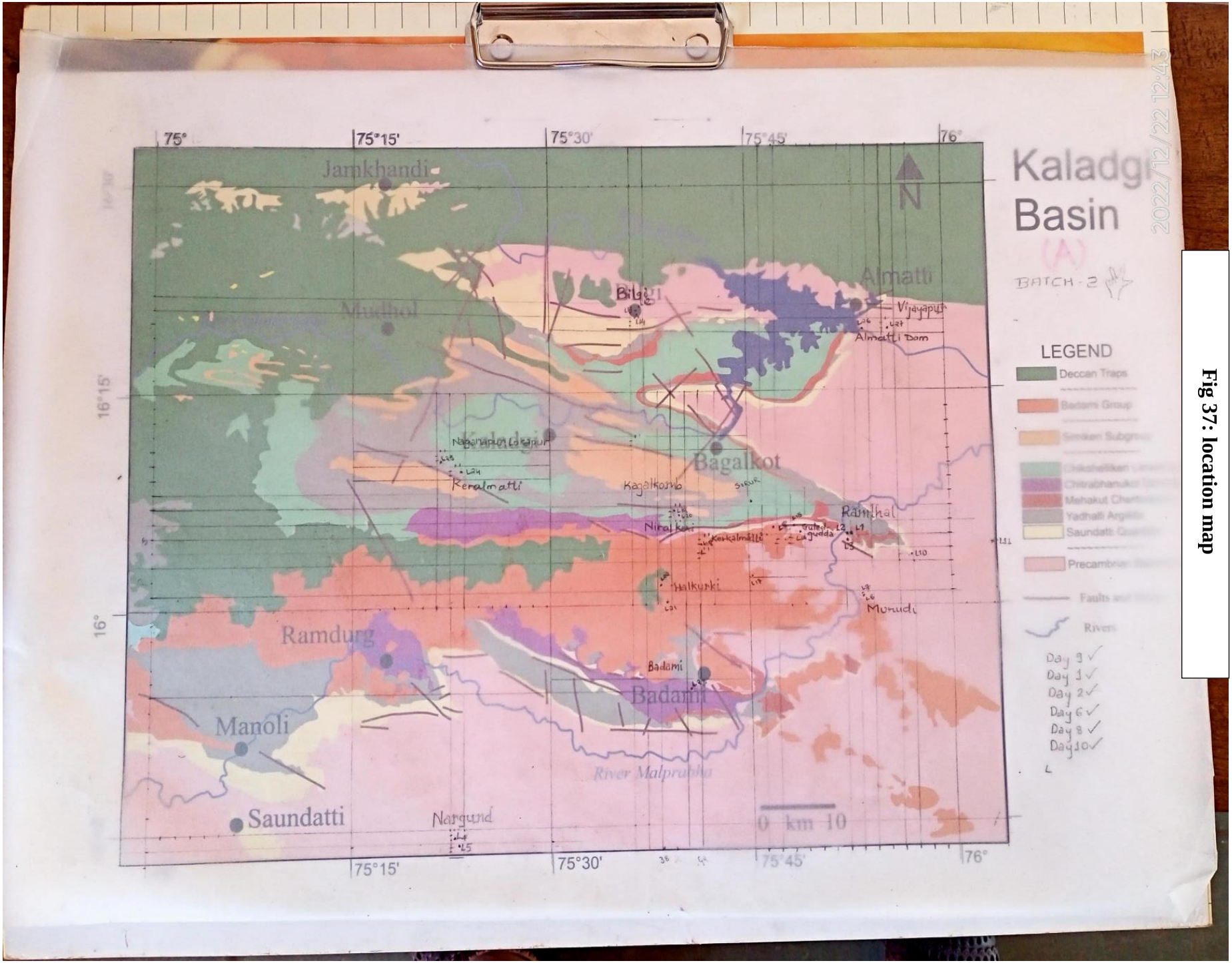

Fig 37: location map

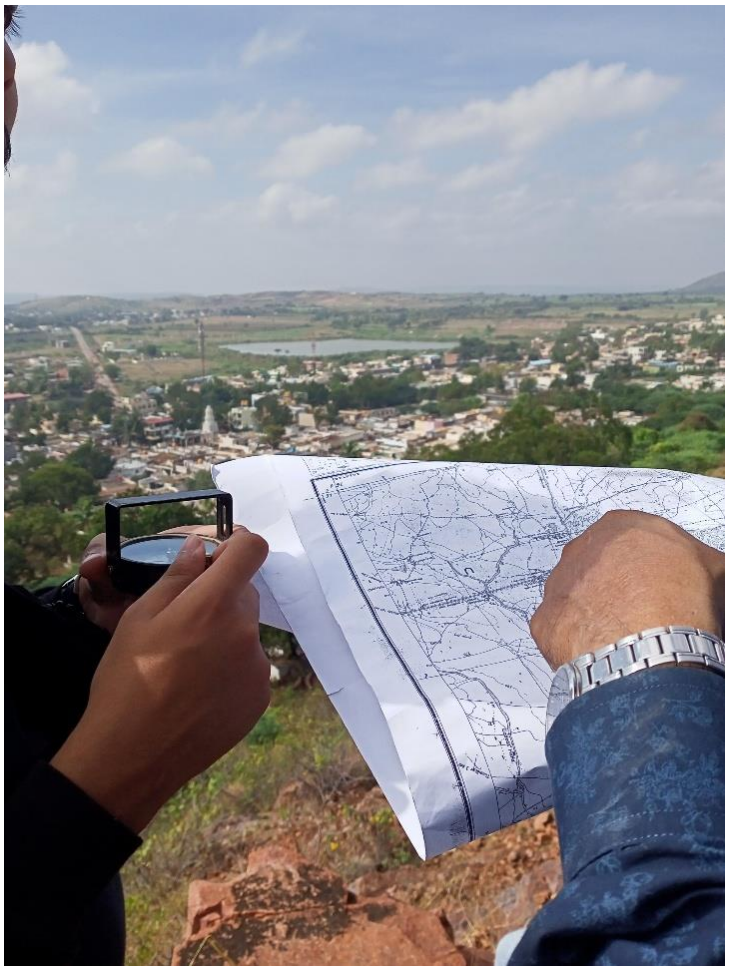

Fig 38 : On the top of the hill, we have located ourselves in the field using back bearing methoy with the help of the clinometer and toposheet we located ourselves with respect to the north of the toposheet and north of the clinometer And kept the compass bridge in the direction of the Ramthal (1st photograph) & Amingad (2nd Photograph) we looked for the highest elevation in the straight direction and took the reading from the outermost circle of the clinometer

CONCLUSION

From the field site visit in the kaladgi Supergroup, it is inferred that the BHQ, BHJ , migmatite from vijayapura and the metapelites of the Hungund schiat belt serve as the basement rock for the Kaladgi supergroup. After this Salgundi conglomerate formation is the oldest rock of the kaladgi sequence of rocks. It is followed by Saundatti Quartzite Over lying Chiksellikere Limestone of the Yendigeri Formation of the Lokapur Subgroup. Bevinmatti Conglomerate of Kundargi Formation marks disconfirmity between the Lokapur Subgroup and the Simikeri Subgroup and overlying is the Muchkundi Quartzite

Bagalkot group and Badami Group is are separated by an angular unconformity. Followed by the Halkurki shale and kokankoppa Limestone of the Katageri Formation of the Badami Group,

This basin is intruded by Granites and pegmatites and the overlying Deccan traps.

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