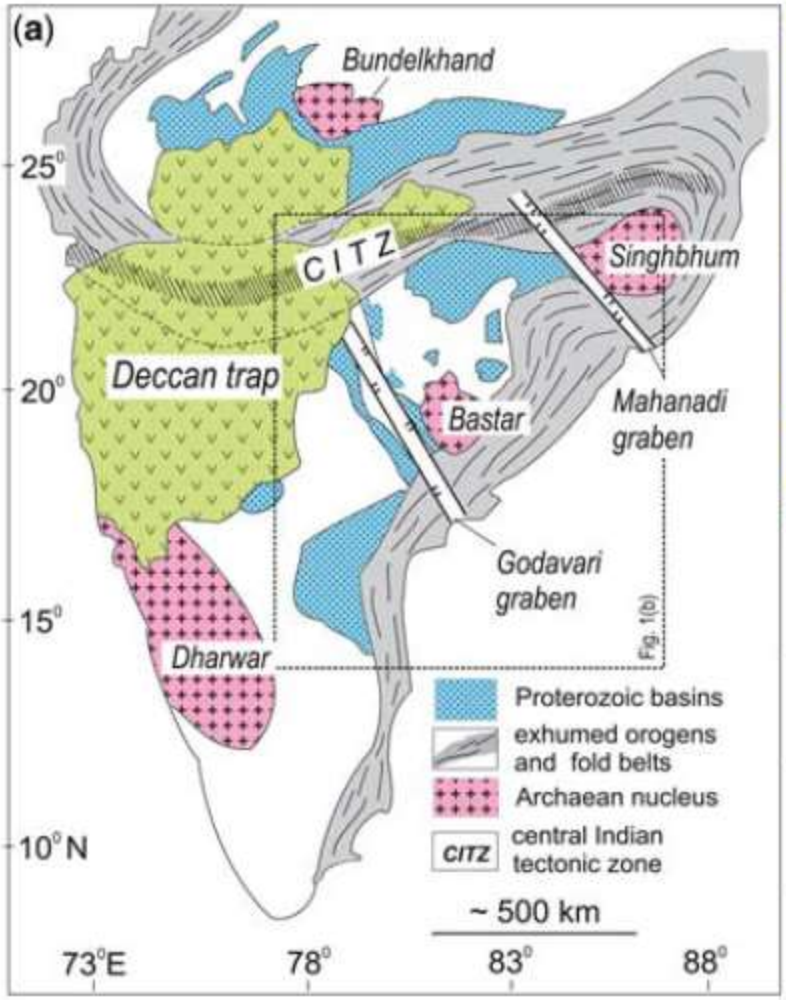
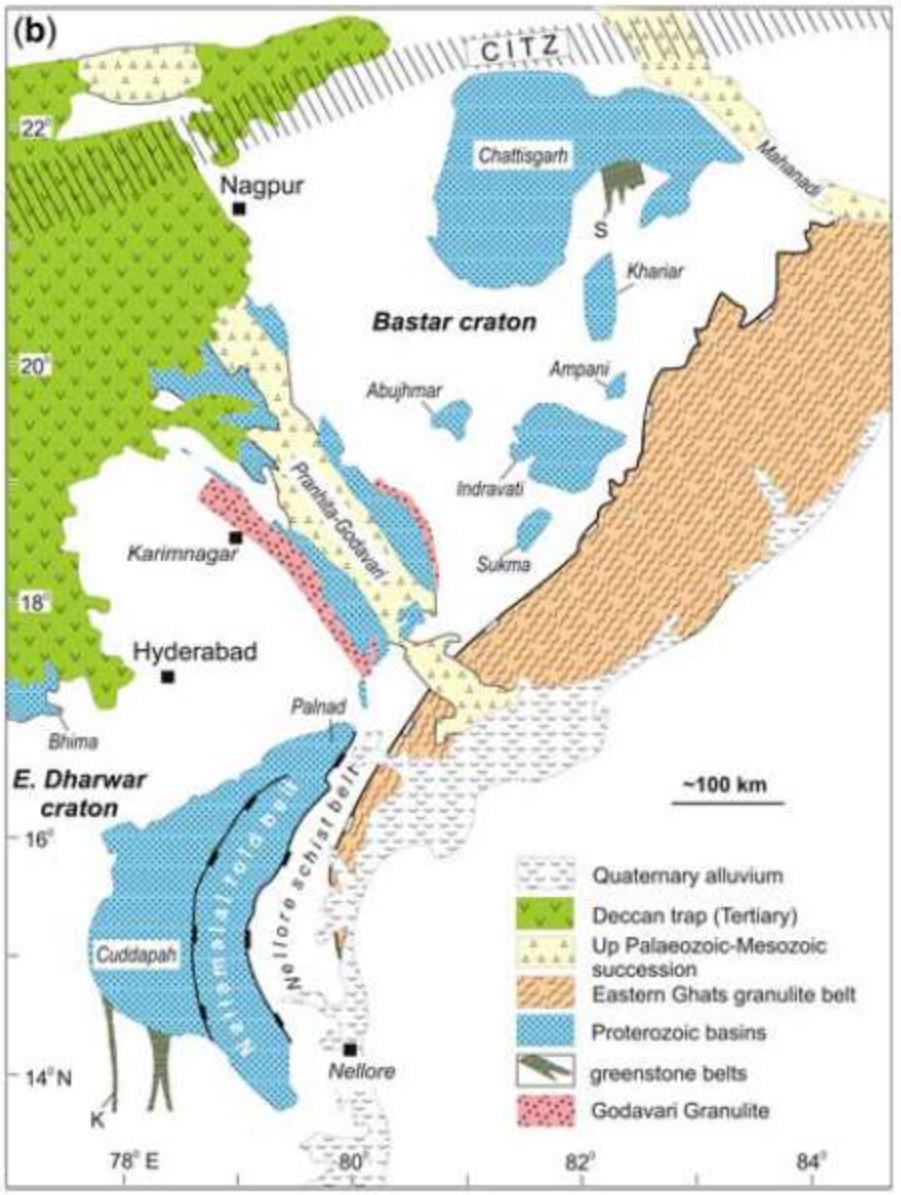
This content is prepared from various sources and has used the study material from various books, internet articles etc. The teacher doesn’t claim any right over the content, it’s originality and any copyright. It is given only to the students of PG course in Geology to study as a part of their curriculum.

CUDDAPAH SUPERGROUP

The Cuddapah Basin, occurring along the eastern margin of the Dharwar Craton, is the largest of the Proterozoic basins in south India.

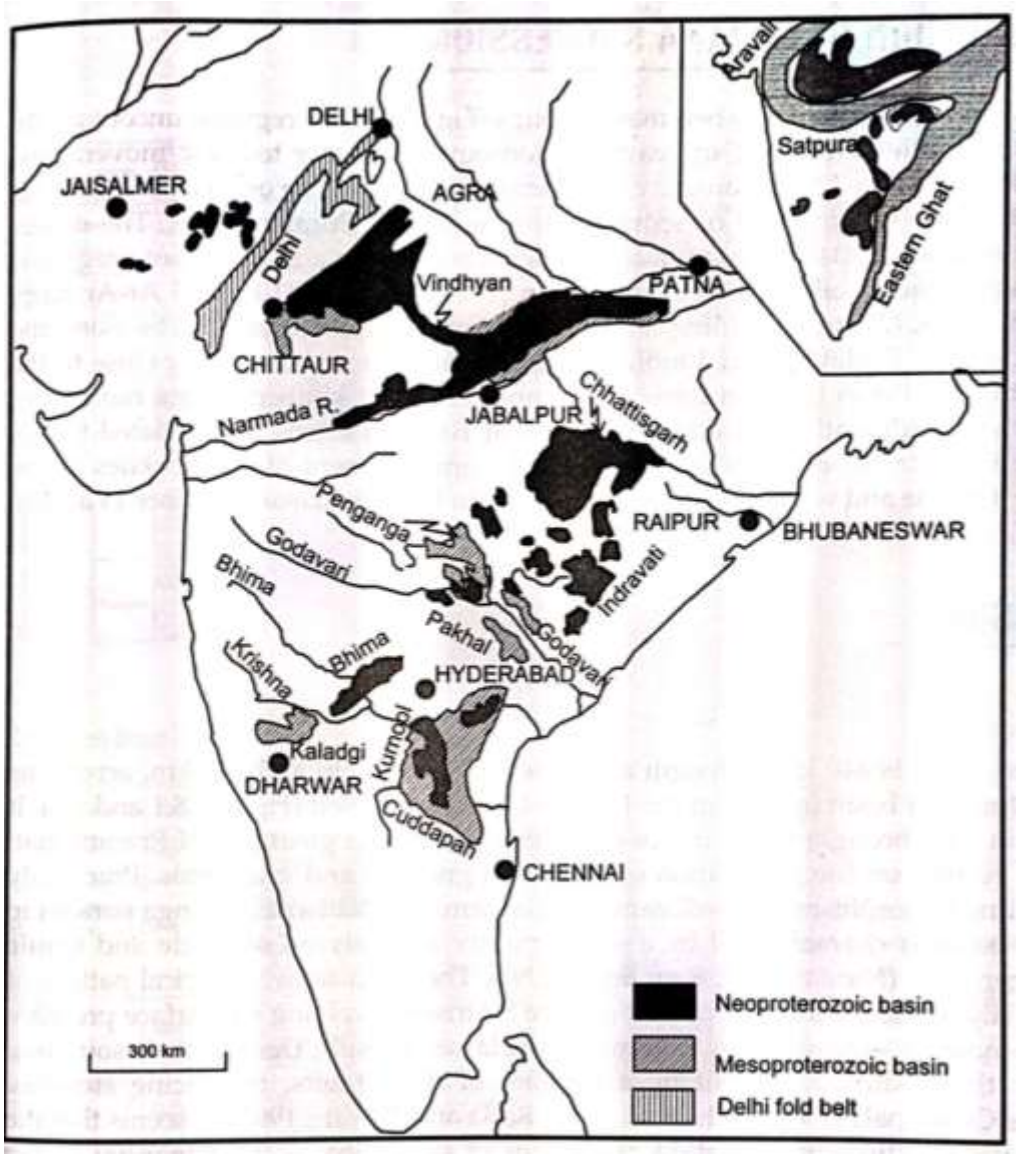




The Proterozoic basins and broad tectonic framework of India. (a) Four Archaean nuclei and the Purana basins of Peninsular India. (b) Proterozoic basins of south India. Eastern Ghats Belt (EGB) occurs at the margin of the Eastern Dharwar and Bastar cratons

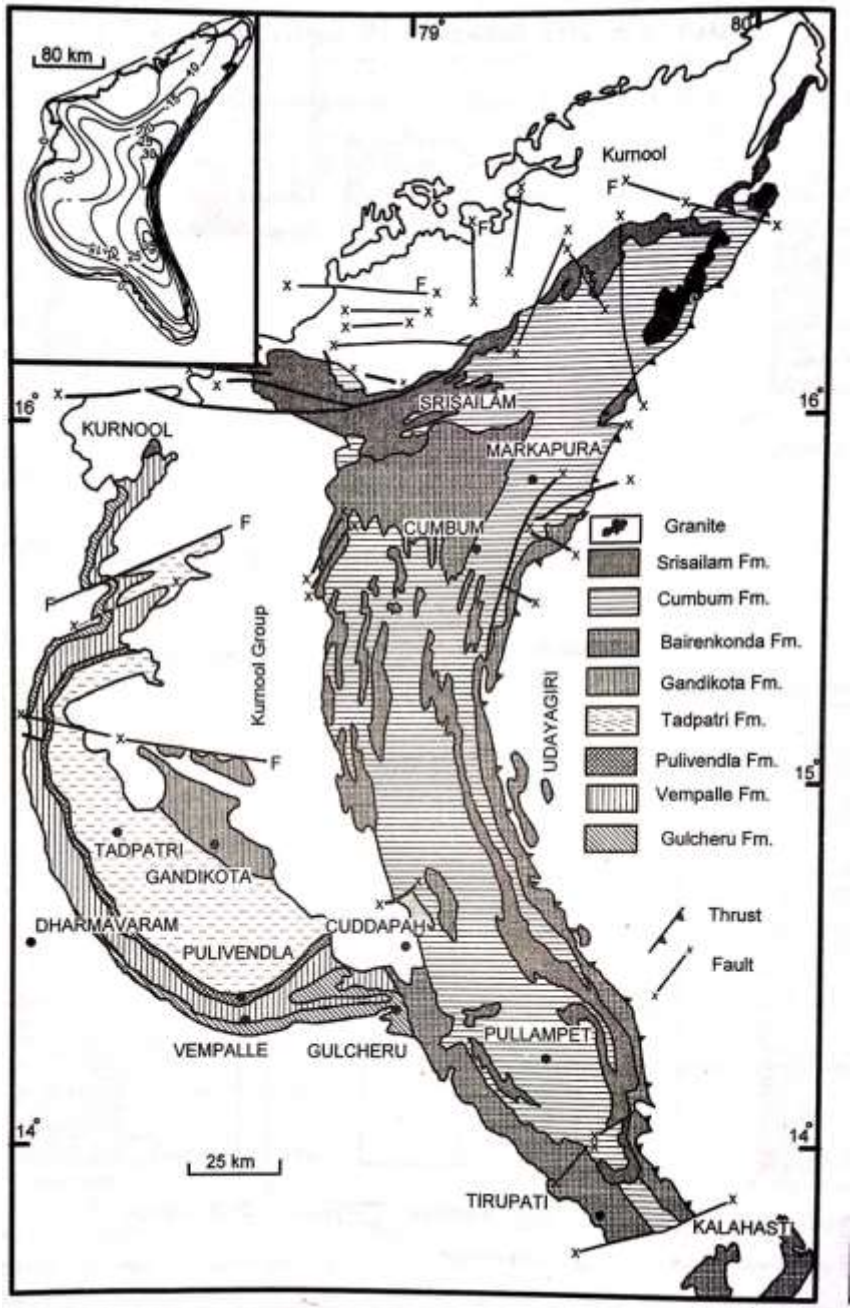
The complex history of the Cuddapah Basin dates back to the Palaeoproterozoic. It records tectonic events that shaped the SE margin of proto-India from when it became part of Columbia. Mafic igneous activity in the lower part of the basin and in surrounding parts of the adjacent cratons has been linked to an approximately 1900 Ma Large Igneous Province (LIP) involving the East Dharwar and Bastar cratons.

Globally, the Palaeoproterozoic saw the onset of a plate tectonics related regime comparable to that in the Phanerozoic. The Eastern Ghats Belt (EGB) in India is considered to have correlatives in the high grade belts of East Anatarctica, as part of reconstructions of the growth of India during the Mesoproterozoic and Neoproterozoic that lead to its amalgamation into the supercontinent Gondwana.



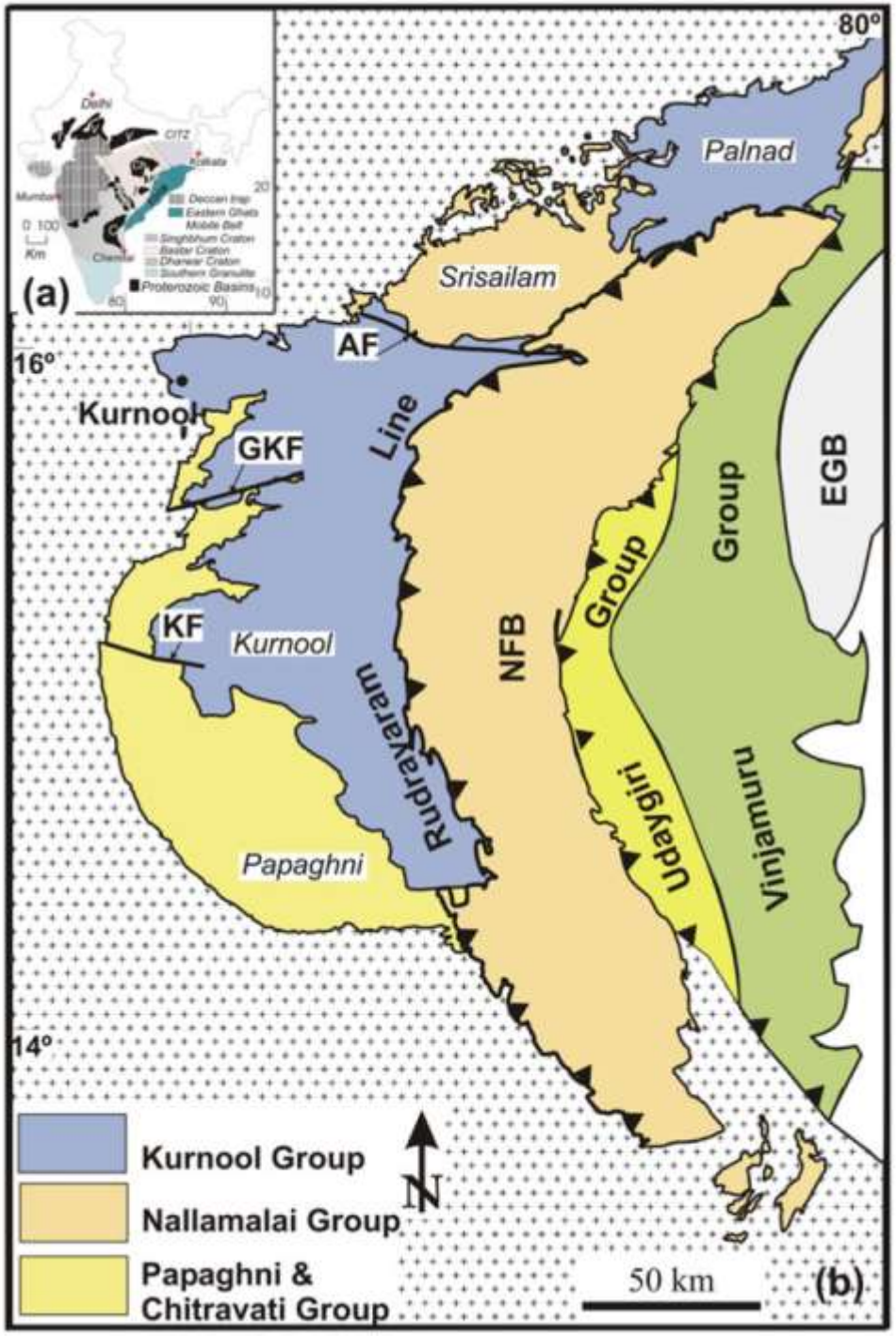
A number of shallow but subsiding basins developed in the wake of Eastern Ghat orogenic movements. Cuddapah Basin evolved immediately west of the EGMB. Vindhyan Basin evolved in the front of the Satpura-Aravalli orogenic belts.

CUDDAPAH BASIN STRATIGRAPHY

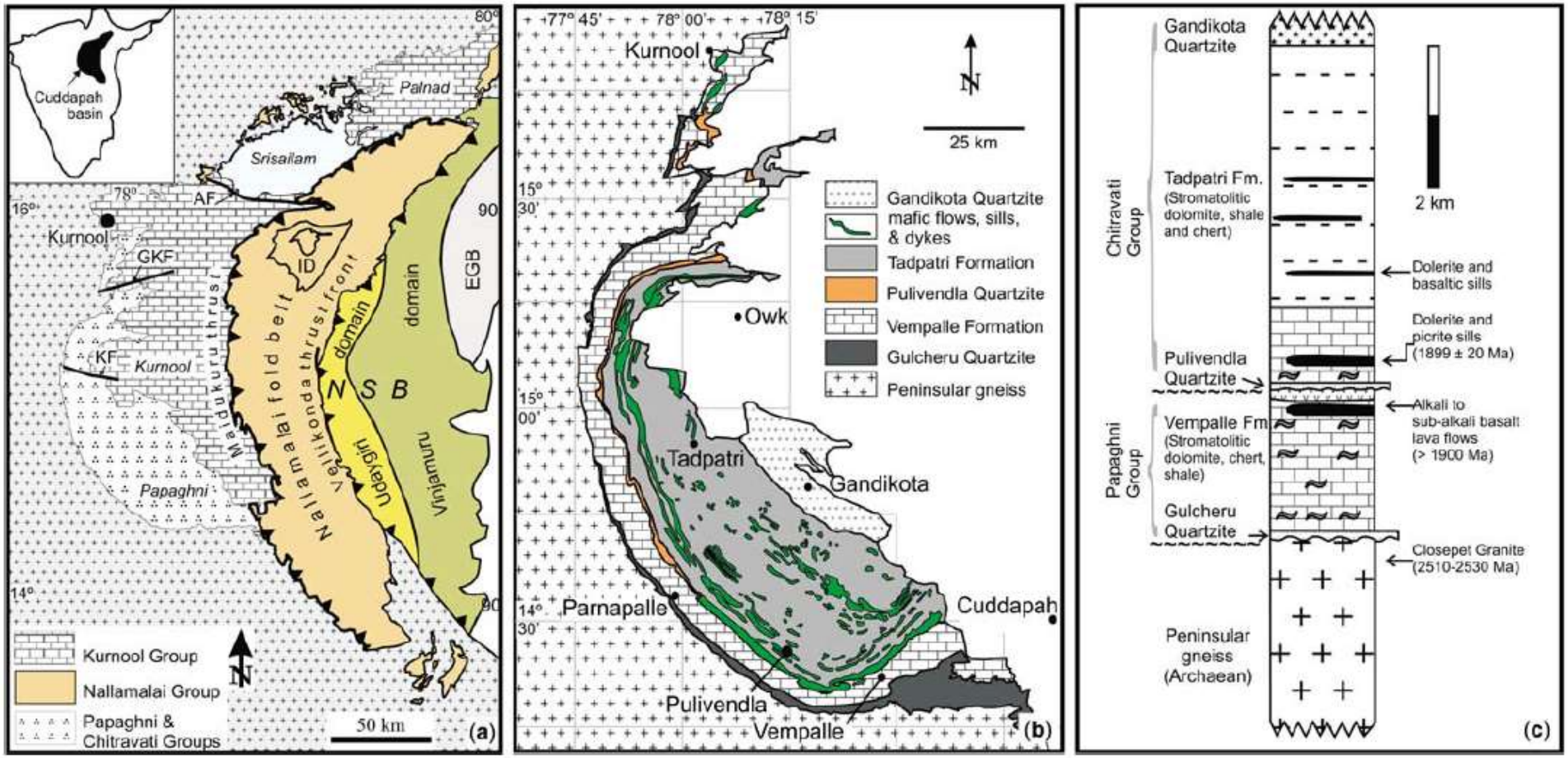


- Crescent shaped basin
- Foreland basin in the front of EGMB
- Proterozoic sedimentary rocks rest up against Archean gneisses and granulites.
- This sedimentary pile shows practically no metamorphism and forms Nallamali Range parallel to the Eastern Ghats.

- Cuddapah Basin evolved through the formation of a series of subbasins- Papaghni in the south-west, Nallamalai in the east, Srisailam in the north-west, Kurnool in the north-east and west.



Four sub-basins within the Cuddapah Basin, namely: the Papaghni sub-basin; the Kurnool sub-basin; the Srisailam sub-basin; and the Palnad sub-basin



Geology of the Cuddapah Basin and its lithostratigraphy. (a) Sketch geological map of the Cudddaph Basin showing the sub-basins, and the boundary thrusts of NFB and NSB.

(b) Geological map of western Cuddapah showing the lower Cuddapah rock groups GKF, Gani–Kalva Fault; AF, Atmakur Fault; KF, Kona Fault.

(c) Generalized litholog for the rock groups in the Papaghni sub-basin and the main geochronological constraints.

The Papaghni sub-basin in the western part of the Cuddapah Basin hosts the Palaeoproterozoic rock groups whose age of sedimentation has been well constrained.

The Nallamalai Fold Belt in the eastern part of the basin hosts a thick shallow-marine succession (the Nallamalai Group) that is intensely deformed. The available geochronological data from the Nallamalai Group suggest the Nallamalai Group to be at least older than about 1400 Ma

Possible late Mesoproterozoic to younger rock groups separated by angular unconformities from the older rock groups of the Papaghni sub-basin or the Archaean basement occur in the Srisailam, Palnad and Kurnool subbasins.

KURNOOL GROUP *500+ m*	Nandyal Shale	
	Koilkuntala Limestone	
	Paniam Quartzite	
	Owk Shale	
	Narji Limestone	
	Banganapalli Quartzite	
~~ Unconformity ~~~~~~~		
	Srisailam Formation	Pebbly grit, quartzite, heterolithic shale-sandstone
– x – x – x – tectonic contact – x – x – x –		
NALLAMALAI GROUP *~1200 m*	Cumbum Formation (≈ Pullampet Shale)	Shale, dolomitic limestone, quartzite
	Bairenkonda Quartzite (≈ Nagari Quartzite)	Pebbly grit, quartzite, heterolithic shale-sandstone
– x – x – x – tectonic contact – x – x – x –		
CUDDAPAH SUPERGROUP	Gandikota Quartzite	quartzite, pebble beds
CHITRAVATI GROUP *4975 m*	Tadpatri Formation	Shale, ash fall tuffs, quartzite, stromatolitic dolomite with mafic flows, sills and dykes
	Pulivendla Quartzite	Conglomerate and quartzite
~~ Unconformity ~~~~~~~		
PAPAGHNI GROUP *2110 m*	Vempalle Formation	Stromatolitic dolomite, shale, basic flows and intrusive
	Gulcheru Quartzite	Conglomerate, feldspathic sandstone and quartzite
~~ Unconformity ~~~~~~~		
PENINSULAR GNEISS		

Lithostratigraphic subdivisions, Cuddapah Basin. The Palaeoproterozoic interval is represented by the Papaghni Group and the Chitravati Group in the Papaghni sub-basin, and possibly also the largely allochthonous Nallamalai Group.

Papaghni Group

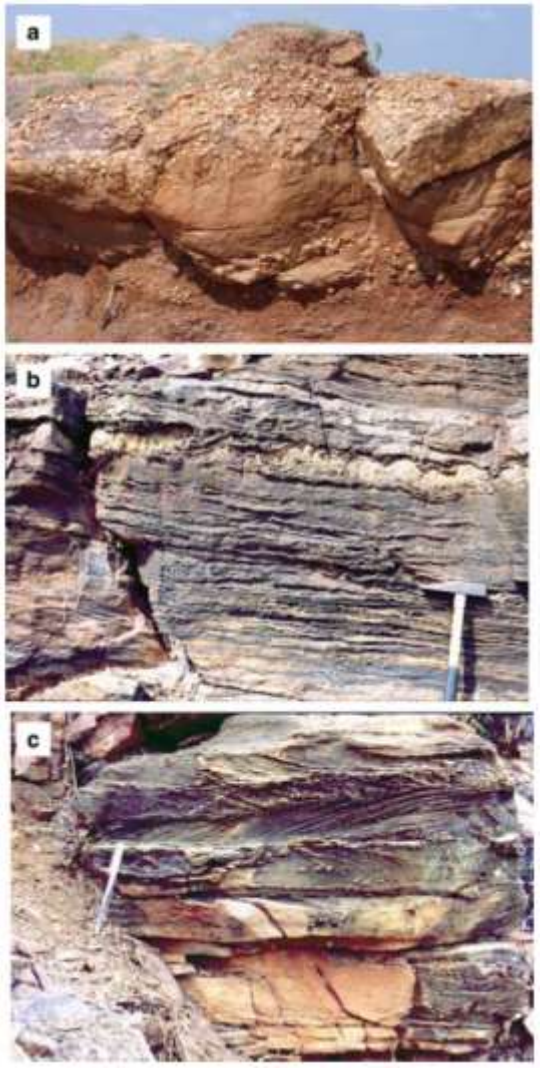
The Papaghni Group consists of two formation rank units: the siliciclastic-dominant Gulcheru Quartzite; and the mixed siliciclastic–carbonate-bearing Vempalle Formation. The latter has many mafic flows, sills and dykes in the upper part of the formation. Although the formation takes its name from Guvvalcheruvu in the Cuddapah district, the basal conglomeratic facies is poorly developed/preserved around this locality. The present description is based on a section from south of Kurnool. Similar facies association are also observed from around Parnapalle.

Gulcheru Quartzite

The basal Gulcheru Quartzite consists of a matrix to clast-supported thick-bedded polymictic conglomerate with occasional interbeds of gritty trough cross-bedded feldspathic sandstone. Subangular–subrounded pebbles of vein quartz, pegmatite, granite, fine micaceous sandstone, black chert and grey shale/argillite suggest their derivation from the adjoining granitoid basement (Peninsular Gneiss) with greenstone patches. The coarse gritty matrix consists of quartz and pink feldspar, locally with ferruginous patches. The common occurrence of trough cross-bedding in the gritty interbeds, channel lags, outsized clasts, lateral thinning out of the stack of conglomeratic beds and a generally fining-upwards facies suggest an alluvial-fan setting for the conglomerate–gritty feldspathic sandstone facies.

The basal facies grades upward to massive to trough cross-bedded gritty–pebbly feldspathic sandstone, which possibly represents sheetflood deposits. Higher up in the section trough cross-stratified units are overlain by medium- to coarse-grained, rippled to cross-stratified glauconitic sandstone with occasional pebbly interbeds. This unit consists of well-sorted subrounded quartz sand with rare feldspar grains.

The topmost unit consists of heterolithic dark brown micaceous shale–fine sandstone with bipolar trough cross–strata, mudcracks and occasional lag pebbles. The association of straight-crested ripples, interference ripples, flat-crested ripples, shallow troughs, mudcracks in the heterolithic facies and occasional lag pebbles suggest the uppermost part of the Gulcheru Quartzite
to be of tidal-flat origin.



Vempalle Formation

The Gulcheru Formation grades upwards to a mixed siliciclastic–carbonate unit with silicified stromatolitic limestone–dolomite beds, calcareous cross-bedded to rippled sandstone and laminated grey-green–brown shale. The lower part of the formation consists of thin-bedded ripple-laminated calcareous sandstone with the local occurrence of herringbone cross-beds, thin gritty units with clasts of lime mud (intraformational flat pebbles) and desiccation cracks in silty units.

Both symmetric and asymmetric ripples are present, and muddy interlaminae show common desiccation crack fills. Biosedimentary structures include stromatolites in the thinly laminated dolomitic units. The upper part of the formation consists of scaly red shales (25 m) with very thin, fine sandy/silty laminae. The lithological association, and the sedimentary and common biosedimentary structures suggest an intertidal–subtidal origin for the carbonates of the Vempalle Formation. The laminated shales at the top suggest shoreface–inner-shelf deposition, possibly during the maximum rise of sea level in the first cycle of sedimentation.

Chitravati (Cheyyair) Group

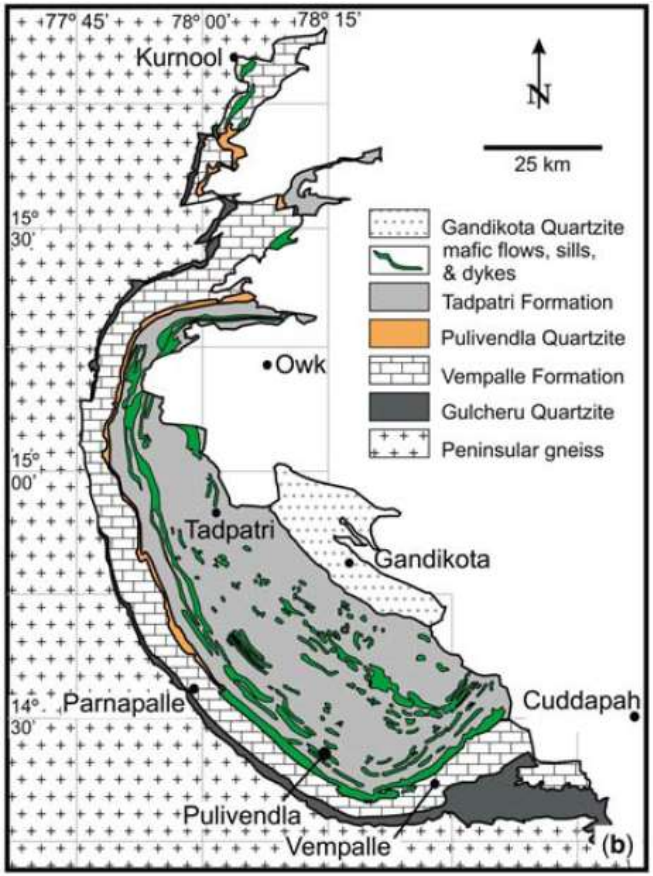
The Chitravati Group consists of three formation rank units: the Pulivendla Quartzite; the Tadpatri Formation; and the Gandikota Quartzite.

The transition from the Papaghni Group to the Chitravati Group is marked by the intermittent occurrence of mafic flows and associated shallow-crustal intrusives in the form of sills and dykes in the underlying Vempalle Formation.

Coeval with the mafic igneous activity, there is deposition of a siliciclastic system – the Pulivendla Quartzite – that grades upwards into a mixed siliciclastic–carbonate system of the Tadpatri Formation. The latter is also marked by the extensive development of mafic sills and dykes .

Pulivendla Quartzite

- consists of medium- to thick bedded well-sorted quartz arenite with sparse pebble beds in the basal part.
- lower part consists of trough cross-bedded, medium-grained well-sorted sandstone (quartzite) with rare lag pebbles.
- grades upwards into a coarser sandstone with trough cross-bed and plane-parallel strata, normally graded mass-flow beds and low-angle cross-strata.
- shallow-channel forms with lag pebbles and well-rounded and well-sorted quartz sands, and a wide dispersal of the trough axis suggest a subtidal bar environment, shallowing upwards into an intertidal environment.
- The Pulivendla Quartzite, with a thickness of about 90 m, grades upwards into the Tadpatri Formation (Fig. 5a).



•***Tadpatri Formation***

•The Pulivendla Quartzite grades upwards into a heterolithic shale–fine calcareous sandstone unit with 30–40 cm-thick dolomitic limestone interbeds.

•The sandy units contain symmetric to asymmetric ripples.

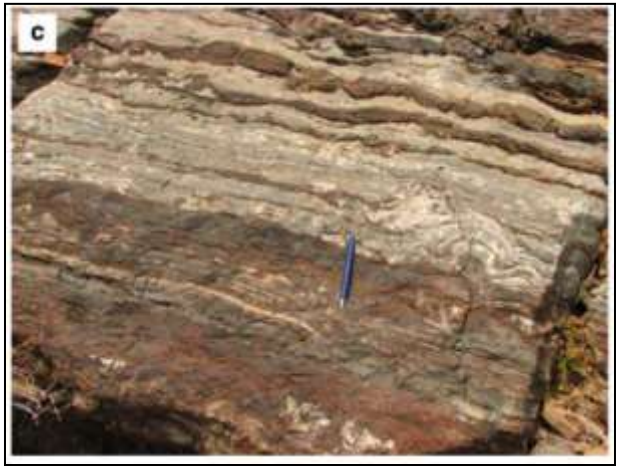
•The dolomitic units show common algal laminites–stromatolitic mounds.

•In some sections, the dolomitic limestone is commonly intruded by thick doleritic sills. These usually show chilled margins and/or contact metamorphic effect in the host carbonates.

•The lithofacies association of algal laminites, stromatolites and rippled fine calcareous sandstone suggests an intertidal–subtidal regime.

•Local asymmetry of the internal laminae of stromatolite forms suggests the influence of tidal currents.

•The development of plane-laminated shales in the upper part of the formation suggests a maximum sea-level rise, suppressing the carbonate factory.

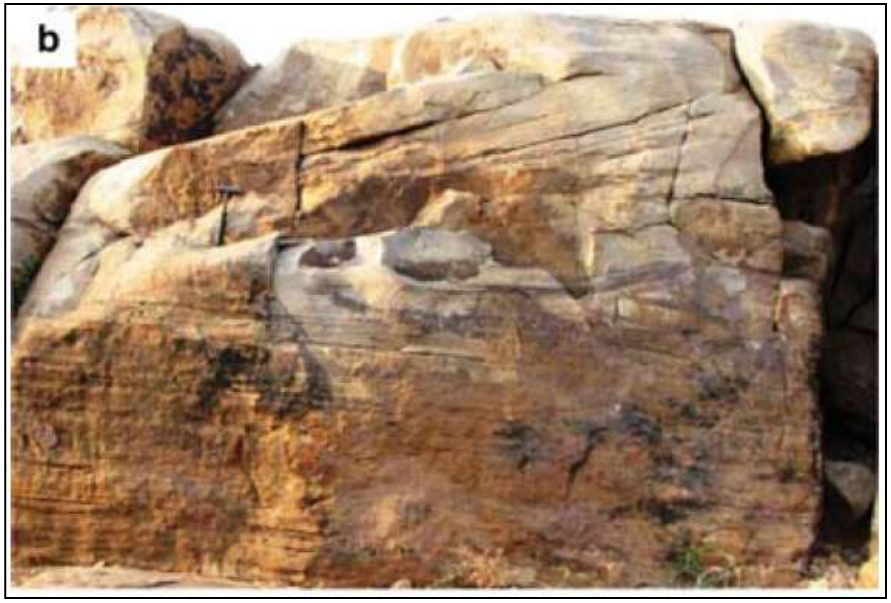


Gandikota Quartzite

In the east-central part of the Papaghni sub-basin, the Tadpatri Formation is overlain by another formation rank unit, the Gandikota Quartzite. The contact is gradational with thinly bedded sand–shale intercalations in the transitional zone giving way to amalgamated quartzite beds with sheet geometry. The bulk of the formation consists of well-rounded well-sorted medium- to coarse-grained quartz arenite with large planar tabular to large trough cross-stratification. Cross-stratified units are intercalated with plane-parallel units and those with straight crested ripples. Deformed crossbeds are common in the upper part. On the whole, Gandikota Quartzite represents a bar–interbar facies with a tidal influence.

Upper boundary of the Chitravati Group

In the western part of the Cuddapah Basin the deposition of the Chitravati Group is followed by a major hiatus, marked by an angular unconformity.



Nallamalai Group

The Nallamalai Fold Belt (NFB) in the eastern part of the Cuddapah basin has folded and faulted metasedimentary rocks constituting the Nallamalai Group.

The contact between the NFB and the western part of the Cuddapah Basin has been interpreted as a thrust.

The Nallamalai Group consists of the lower sandstone-dominated Bairenkonda Quartzite and the upper Cumbum Formation, consisting mainly of shales with sandstone and dolomite intercalations.

Bairenkonda Quartzite shows coarse to pebbly trough cross-stratified and rippled sandstones overlain by a hummocky cross-stratified sandstone–siltstone. Straight crested ripples are common in coarse- to medium-grained sandstones with desiccation features. This then grades into plane-laminated shale interstratified with glauconitic sandstone. Further up, a shaly unit with intercalations of dolomite and ferruginous quartzite mark the transition to the Cumbum Formation . An oolitic ironstone facies occurs within the ferruginous quartzite.

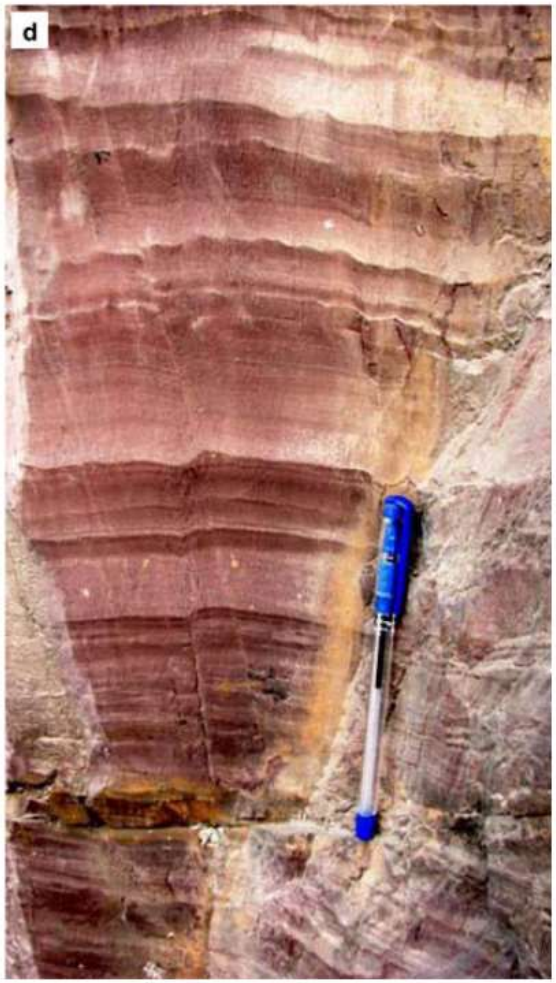
The quartzite-dominant part with minor quartz phyllites (protoliths of micaceous sandstone and shale) in the lower part is regarded as the Bairenkonda Subgroup, and the upper phyllitic and quartzite intercalation is regarded as the Cumbum Subgroup.

The lower part of the Cumbum succession consists of grey-green slate (shale) with centimetre-thick fine-grained sandstone interbeds, and, locally, with massive dolomitic interbeds. A thick green phyllite with thin quartzite intercalation at grades upwards to a medium- to fine-grained quartzite with plane parallel strata, ripples and large planar tabular cross-strata with tidal bundles (Fig. 9).

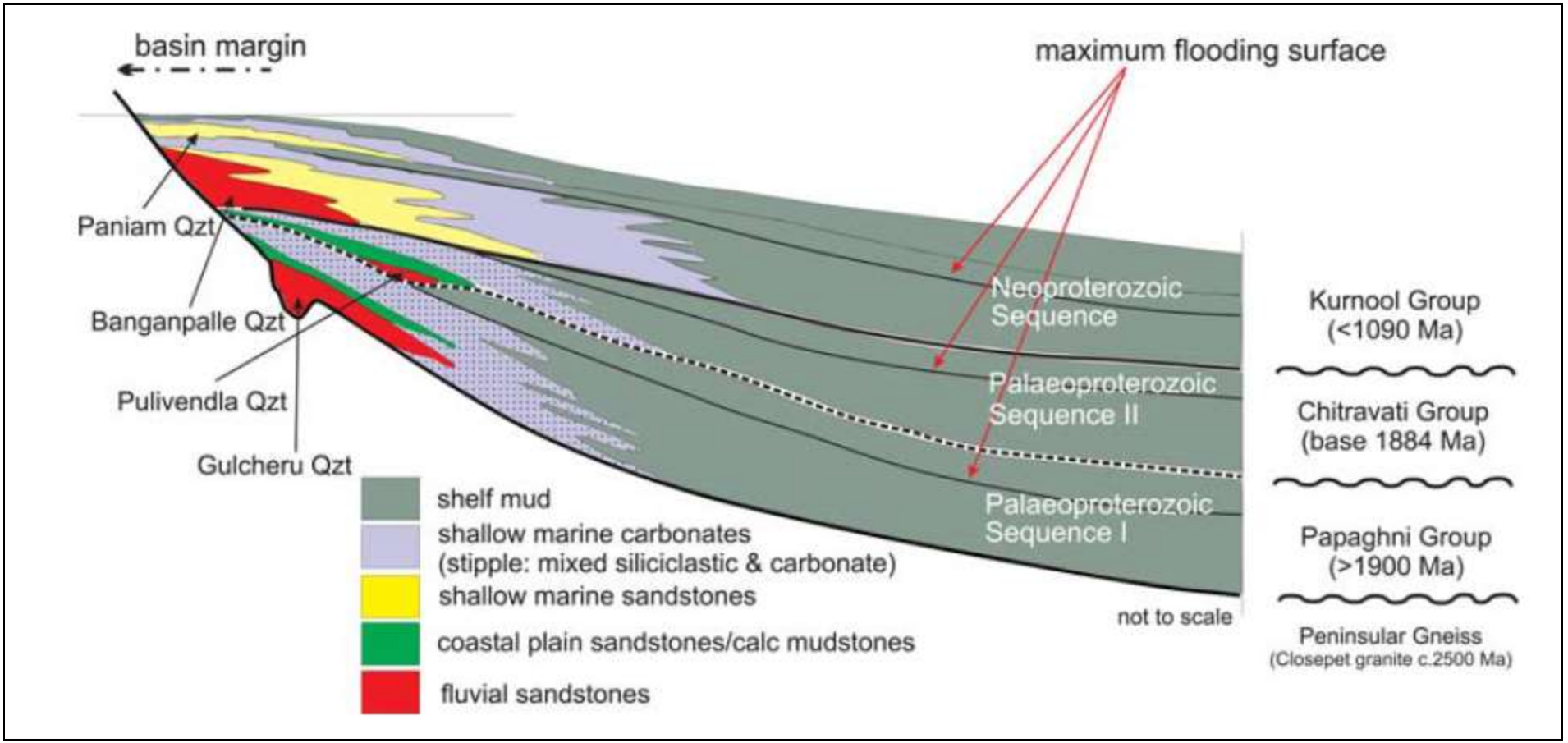
The presence of ash beds, mass-flow conglomerates with clasts of intrabasinal carbonates, slumped beds, etc., suggest synsedimentary faulting and volcanism during the deposition of the Pullampet– Cumbum Formation.

The shale–siltstone-dominant middle part of theCumbum Formation may represent turbidites . The quartzite-dominant upper Cumbum Formation represents subtidal bars–peritidal deposits.

Facies and sedimentary structures in the Bairenkonda Quartzite.
(a) Alternate thick (amalgamated beds) and thin bedded (rippled) quartzite, lower Bairenkonda Quartzite.
(b) Unit with symmetrical ripples alternating with those with plane-parallel or low-angle stratification.
(c) Trough cross-bedded quartzite; note the herringbone strata.



Facies and sedimentary structures in the Cumbum Formation. (a) Plane-laminated shale with fine sandstone Interbeds
(b) Plane-parallel to cross-stratified quartzite in the upper Cumbum Formation
(c) Tidal bundles in the quartzites, upper Cumbum;
(d) Graded beds in the middle part of the Cumbum Formation



Schematic section across the western part of the Cuddapah Basin showing the major sequence boundaries. Three unconformity-bound sequences are indicated.

Srisailam Quartzite Formation

The Srisailam Quartzite (600+ m) unconformably overlies the granite gneiss basement along its western contact and is in thrust contact with the Nallamalai Group along its southern boundary. It is composed mostly of well sorted, medium-grained, purple subarkose to quartz arenite, ferruginous and glauconitic in places. Successive beds are separated by siltstone and mudstone unit with beds ranging in thickness from 3 to 5 cm. The amalgamated beds occur as laterally persistent sheet-like bodies with well-developed pinch-and-swell structures and sharp boundaries.

The sandstones are texturally and compositionally very homogeneous and consist of well-rounded to sub-rounded, well sorted medium-grained quartz. The beds are profusely cross-stratified, both trough and planar type, often with well developed herringbone structures and backflow ripples. The upper surfaces of the beds are sculptured with symmetric to slightly asymmetric, sinuous and straight-crested ripples often mantled by very coarse sands and granules. Desiccation cracks and wind ripples are observed on top of many of the thicker beds. Trough cross-stratified, medium- to coarse-grained immature channel-fill sandstones is present at different levels. Very well sorted sandstone of the Srisailam Formation with amalgamated cross-stratified beds with mudstone drapes and interlaminated sandstone–siltstone and mudstone are products of flows modified by various tidal beats. Sands were transported during the ebb and flood stages, and mudstone accumulated during slack-water phases.

AGE OF THE CUDDAPAH BASIN

Radiometric dating by Ar/Ar method of mafic dykes/sills within the Tadpatri Formation or U–Pb ages of Baddeleyite from the same horizon, suggests that sedimentation was initiated before 1.9 Ga. The Chelima lamproites, which intrude into the Cumbum Formation, the upper formation of the Nallamalai Group, gives a 1.38 Ga age. The assemblages of algal stromatolites in different formations of the Supergroup indicate a middle to upper Riphean age. However, the reports of diamonds in the basal conglomerates of the Banganapalle Quartzite (Kurnool Group), apparently derived from 1050Ma kimberlites west of the Cuddapah Basin, or reports of a 980Ma dolerite intruding the Kurnool rocks, keep the debate open that the Kurnool Group could be Neoproterozoic.

CUDDAPAH SUPERGROUP

CUDDAPAH SUPERGROUP	KISTNA/ KRISHNA GROUP	SRISAILAM FM.	Quartzite
		KOLAMNALA FM.	Shales
		IRLAKONDA FM.	Quartzite
	/\		
	NALLAMALAI GROUP	CUMBUM FM.	Shales
		BAIRENKONDA FM.	Quartzite
	/\		
	CHEYAIR/ CHITRAVATI GROUP	TADPATRI FM.	Shales
		PULIVENDLA FM	Quartzite
	/\		
	PAPAGHNI GROUP	VEMPALLE FM.	Shales and Limestones
		GULCHERU FM.	Quartzite

/\

ARCHEAN GNEISSES