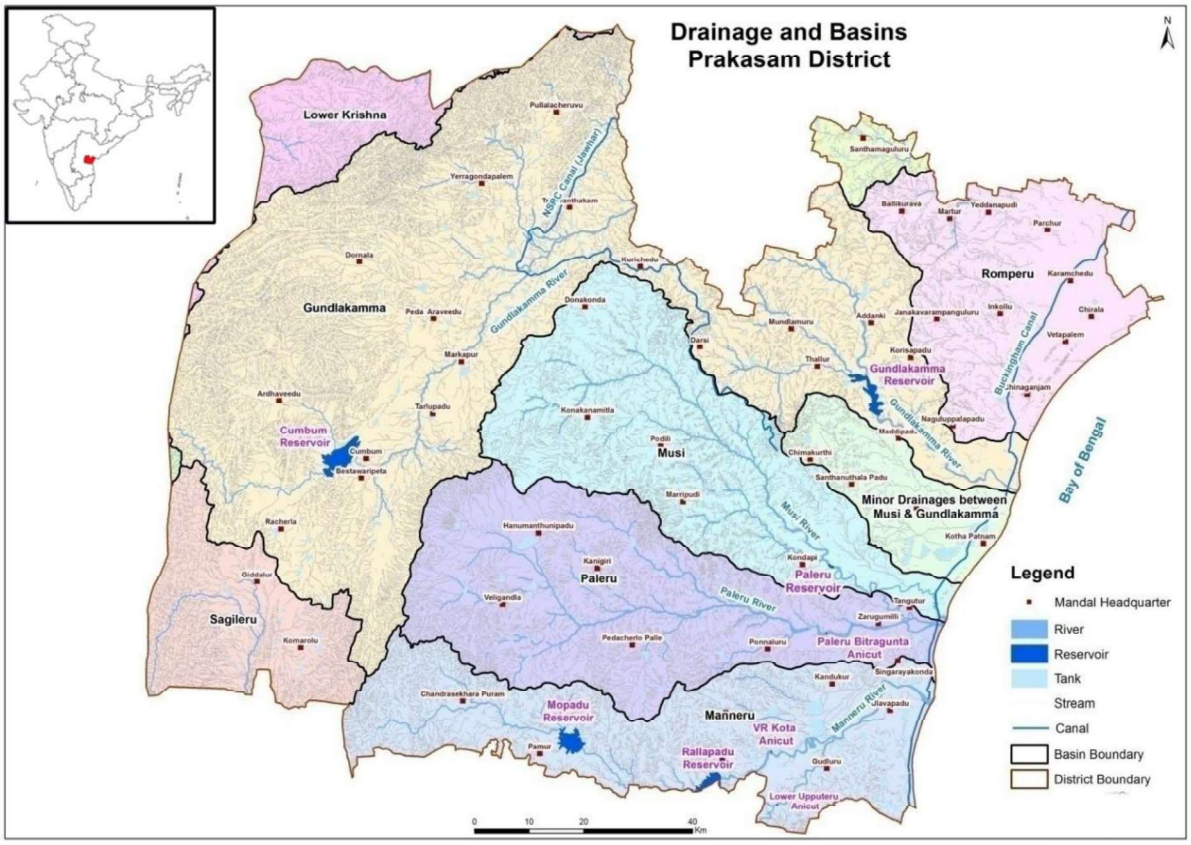
CHAPTER 2
STUDY AREA: PHYSIOGRAPHIC AND CULTURAL SETTING

The current study investigated the Prehistoric potentials of the Gundlakamma and adjoining river basins. This region constitutes the administrative District of Prakasam in Andhra Pradesh, India. The study area, situated between 15º to 16º north latitudes and 79º to 80º east longitudes, occupies an area of 10,000 sq. Km. Four rivers drain the area: the Gundlakamma, the Paleru, the Musi and the Manneru, which forms a fan-shaped basin between the major east-flowing rivers, the Krishna in the north and the Pennar in the South (Map. 2.1). These three rivers have their origins in the Nallamalai ridge, which forms the western flank of the study area. On the east, it is bounded by the Bay of Bengal. The whole basin politically comes under the Prakasam District, Andhra Pradesh.



Map. 2.1: Drainage network and river basins of the study area (Source: After Andhra Pradesh Space Applications Centre, 2018).

Gundlakamma is the largest of the four rivers, rising at an elevation of roughly 800 metres MSL near Gundlabrahmeswaram in the Nallamalai hills. After moving into the plains, it creates

two large lakes, one at Cumbum and the other at Markapur in Prakasam District and flows in a north-easterly direction and enters Guntur District. Then it turns southeast, eventually joining the Bay of Bengal at Ulichi village. The principal tributaries of the river Gundlakamma are Chamavagu, Rallavagu, Pogullavagu, Duvvaleru, Jampaleru, Tigaleru, Koneru, and Chilakaleru. The river's main channel is around 220km long, and the Gundalakamma system forms a sub-dendritic to sub-parallel (Reddy & Shah, 2004) type drainage pattern. The entire drainage network of the river is influenced by the fracture pattern prevailing in the base rock formations.

The remaining three rivers, the Musi, the Paleru and the Manneru, are independent east-flowing streams. The Musi originates in the Velikonda hills near Thadivaripalli village in Prakasam District's Podili *taluka*. The Paleru river is 122 kilometres long and originates near Vedulla Cheruvu in Prakasam District's Kanigiri *taluka*. The principal tributaries are Dommaleru, Narellavagu, Makeru, and Gadisaleru. The Manneru originates in Kanigiri *taluka*, Prakasam District, north of Pillipalli village. The Dokkalavagu, Uppuvagu, Pillaperu, and Upputeru are the primary tributaries of the Manneru, and the river runs 130 kilometres east before emptying into the Bay of Bengal. These three rivers drain through the Velikonda hills in their upper reaches and enter the plains in their middle and lower reaches. Rugged and hilly landscapes represent the upper reach of the area, and middle and upper reaches are covered by a moderate to low altitude hill range.

In the Prakasam district, the sea wind moderates the climate in winter and summer, particularly in the District's coastal areas. The temperature in the District's inland areas, particularly the highlands, is extreme in the summer. The area receives rainfall from both the southwest and northeast monsoons. The southwest monsoon season (June to September) receives 46.93 per cent of the total annual rainfall, whereas the northeast monsoon period (October to December) receives 42.22 per cent (Andhra Pradesh Space Applications Centre, 2018). Droughts and cyclones commonly strike the District. The District's highest and minimum average temperatures are 38.20° C and 19.70° C, respectively. The highest temperatures are usually reported during the summer, notably in May and June. Throughout the year, the climate of the Prakasam district is characterized by humidity. The seasonal rainfall is moderately good, despite the oppressive heat.

The summer season is followed by the Southwest monsoon, which lasts until the second week of October. From mid-October until the end of November, the receding Northeast monsoon

begins. February has a good climate for the most part. In the hot summer months, from April to June, the mean most severe temperatures are often high (35° C to 37° C). The mean most extreme temperature is often low and falls to 15° C in December and 12° C in January. The average maximum temperature swings between 39° C and 29° C from July to November. In general, low sunlight occurs in October, which corresponds with the flowering time of the District's rice harvest.

2.1 Geology

Geologically the whole region is part of the eastern margin of the Cuddapah sedimentary basin. The Western part of the study area is embodied by NNE-SSW trending structural ridges with an elevation of 842 m (Ramam & Murty, 2012). Iswarakuppam hill in the northwest is the highest elevation (901m) in the District, which is a structural dome consisting of Bairenkonda quartzite. The eastern part of the area is a pediplain consisting of a few isolated hills like Nishan Konda (665 m) and Chimakurti (658 m), surrounded by Quaternary sediments forming an alluvial plain.

The area includes rock units from the Eastern Ghats Super Group's Khondalite Group and Charnockite Group, unclassified Metamorphics, Archaean-aged Dharwar Super Group, Younger Igneous Intrusives, Proterozoic-aged Cuddapah Super Group, Kurnool Group, Upper Cretaceous-aged Upper Gondwana sequence, Cenozoic laterite, and recent alluvium (Table. 2.1.1 and Map. 2.1.1). The Khondalite group, which consists of gneiss with small quantities of quartzite, can be observed on the eastern outskirts of the Chimakurti region and quartzite rocks of the charnockite group are visible near Addanki as pyroxene granulite. The region's east and southeast are dominated by unclassified metamorphic rocks made of migmatised quartz-feldspar-mica schist with amphibolite. In the south-central section, kyanite-staurolite-biotite-muscovite schist with garnet porphyroblasts, ferruginous quartzite, and crystalline limestone make up the highest unit of these unclassified metamorphics. Quartz-chlorite-sericite schist with minor quartzite that is part of the Dharwar Supergroup of rocks is visible on the eastern margin of the thrust contact of the western part of the Cuddapah Basin. The area exposes numerous igneous intrusives. Massive, irregular masses of pale pink to grey gneissic granite and hornblende are found in the south-central portion of the region. Around Addanki, Darsi, and Podile, greenish-pink, coarse-grained granite appears as distinct uneven forms and protrudes into the Eastern Ghats and Dharwar Super Group. Hornblende syenite rock occurs as minor, separate ridges around Podile and at localities, it is interspersed by a nepheline-bearing

pegmatite. About 14 kilometres northwest of Addanki and 11 kilometres east of Podile, two minor masses of nepheline syenite are visible.

Table. 2.1.1: Geological Formations identified in the Prakasam District (after Ramam & Murty 2012).

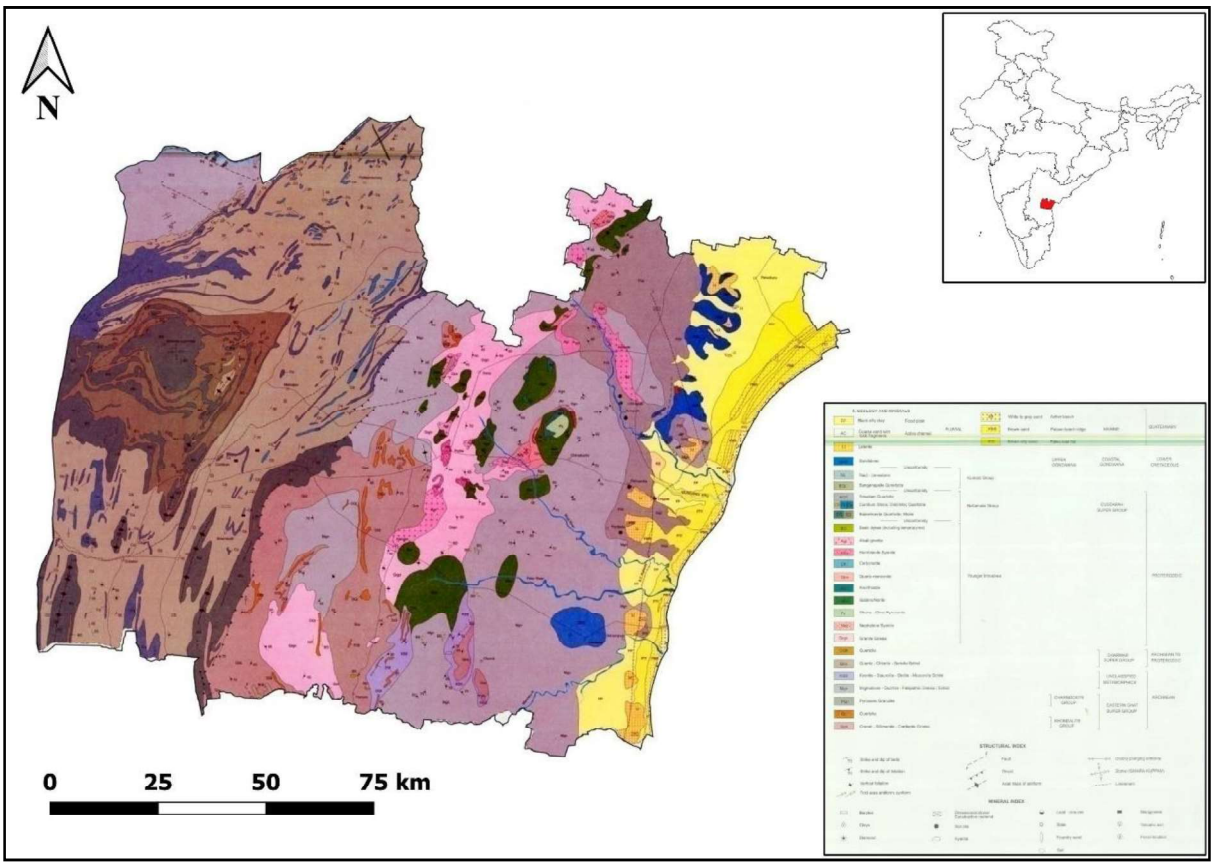
Age	Supergroup	Group	Formation	Lithology
Quaternary			Aeolian	Yellowish Sand
				Dark red sand
			Fluvial	Black Silty clay
				Coarse sand
				Laterite
			Marine	White to grey sand
				Brown Sand
				Brown Silty Sand
Lower Cretaceous	Coastal Gondwana	Upper Gondwana		Sandstone
Proterozoic	Cuddapah	Kurnool	Narji	Limestone
			Banaganapalle	Quartzite
		Nallamalai	Srisailam	Quartzite
			Cumbum	Shale, Dolomite, Quartzite
			Bairenkonda	Quartzite, Shale
		Younger Intrusives		Basic dykes,
				Alkali granite,
				Hornblende Syenite
				Carbonalite
				Quartz monazite,
				Anorthosite
				Gabbro/Norite
				Olivine-Clino Pyroxenite
				Nephelene Syenite

				Granite Gneiss
Archean to Proterozoic	Dharwar			Quartzite
				Quartz-Chlorite-Sericite Schist
Archean	Unclassified Metamorphics			Kyanite-Staurolite-Biotite-Muscovite schist
				Migamatised-Quartzo-Feldspathic Gneiss/Schist
	Eastern Ghat	Charnockite		Pyroxene Granulite
				Quartzite
		Khondalie		Granet-Sillimanite-cordierite Gneiss

Around Darsi-Podile and Kanigiri, basic to ultrabasic plutonic rocks are revealed as uneven, sub-elliptical masses in a small area running NNE-SSW, and these masses have a multilayer structure with olivine in them. The western margin of basic-ultrabasic forms seen about 18 km east of Podile contains fayalite-quartz monzonite. A minor isolated occurrence of baryte in carbonatite has also been discovered around 7 km ENE of Podile. NNW-SSE to NNE-SSW and E-W basic dykes are typically found in the south.

The Cuddapah Super Group is represented by the Nallamalai Group, which includes the Bairenkonda (Nagari) Formation, Cumbum (Pullampet) Formation, and Srisailam Quartzite. Slate and quartzite make up the Bairenkonda Formation. The quartzite is exposed in linear masses beside the western boundary of the Cuddapah Basin, and it forms the Iswarakuppam Dome in the northwest at Dornala. Shale dominates the Cumbum Formation, with little phyllite and intercalations of dolomite, limestone, and quartzite. Srisailam Quartzite, primarily an arenaceous unit with a sub-horizontal dip, is unconformably overlain by the Nallamalai Group. It is glauconitic and ferruginous and forms a plateau in the northwest. The Srisailam quartzite is unconformably overlain by the Kurnool Group, characterized by Banganapalli quartzite and Narji limestone. The bottom unit of the Banganapalli quartzite is a diamondiferous conglomerate and appears as tiny masses in the northwest, near the Krishna River. The conglomerate is covered with quartzite and shale. Narji limestone rests on top of the Banganapalli quartzite and is made of leggy and massive limestone. Lower Cretaceous

Gondwana formations lay non-conformably on top of Archaean rocks. They are found as outliers in Vemavaram, near Idupulapadu-Punuru and Budavada-Pavuluru. Uppugonduru and the Kandukur area are made up of sandstone and shale intercalations. Several ferruginous laterites can be found in the east, over the Gondwana and Archaean rocks, at low elevations of 16 to 38m MSL. Quaternary sediments are found along the shore and divided into three depositional environments: residual, marine, and fluvial. Residual soils reflect the residual environment, flood basins and active channel deposits represent the fluvial environment, and palaeotidal, palaeobeach, and active beach ridges represent the marine environment. Buff-coloured volcanic ash is found in patches along the Gundlakamma River terraces, linked to the Toba volcanic activity of 74 ka. The valley has also yielded fossils of Elephus and Equus molars, pre-molars of Equids, horncore of the stag, and turtle shell. Fossils of Bovid and Cervid limb bones are also reported from the valley.

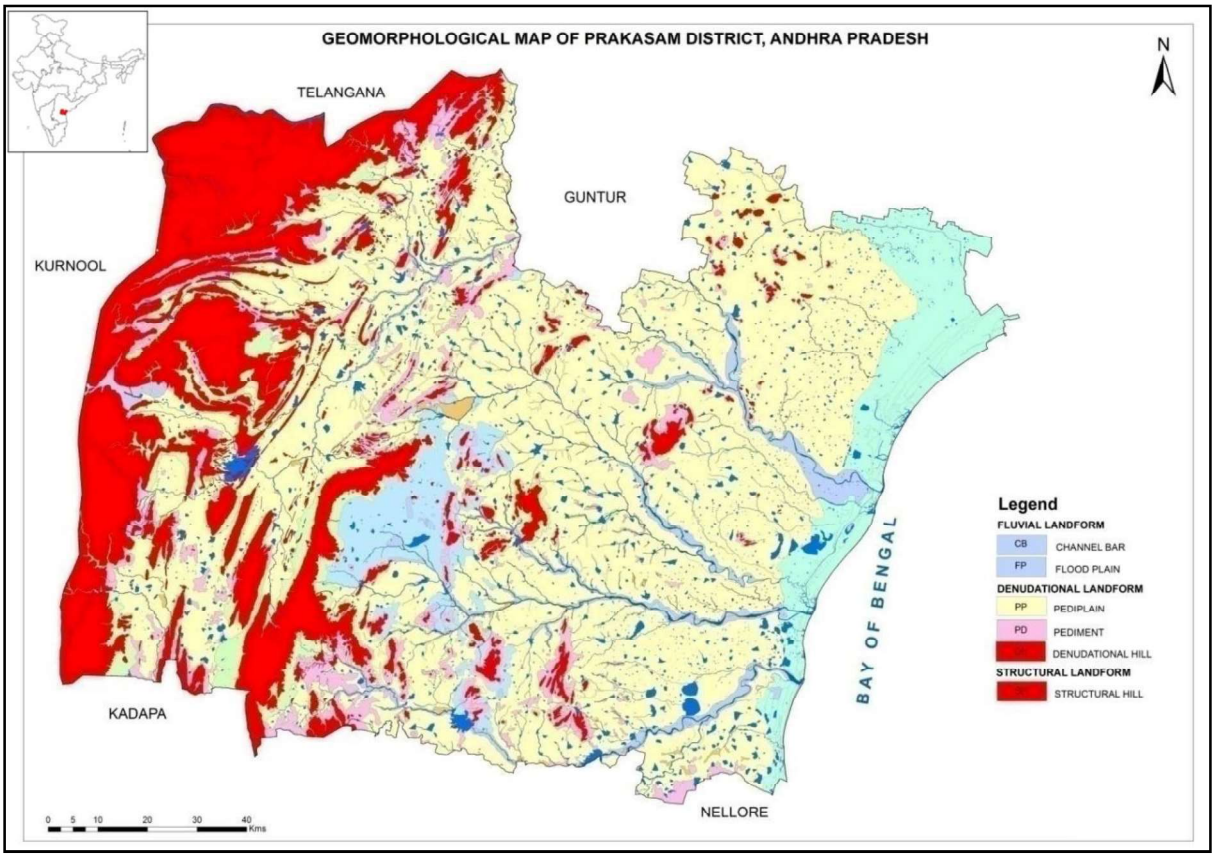


Map. 2.1.1: Geology of Prakasam District, Andhra Pradesh (Source: After Geological Survey of India, 2000).

2.2 Geomorphology

Landforms in the District's north, northeast, mid-central, and south-eastern regions include coastal, and flood plains with recent alluvium and marine sediments (Map. 2.2.1). The North,

South, and Central sections of the District have structural and denudational plateaus on proterozoic rocks with pediments and pediplains. The northwest, central, and southwestern areas of the region have structural & denudational hills, valleys on sedimentary rocks, and colluvial terraces. Linear ridges, residual and structural hills, and shallow to moderately weathered pediplain deposits are all found in the Dharwar schist, Charnockites, and peninsular gneisses.



Map. 2.2.1: Geomorphology of Prakasam District (Source: After Andhra Pradesh Space Applications Centre, 2018).

2.3 Prehistoric remains and their context.

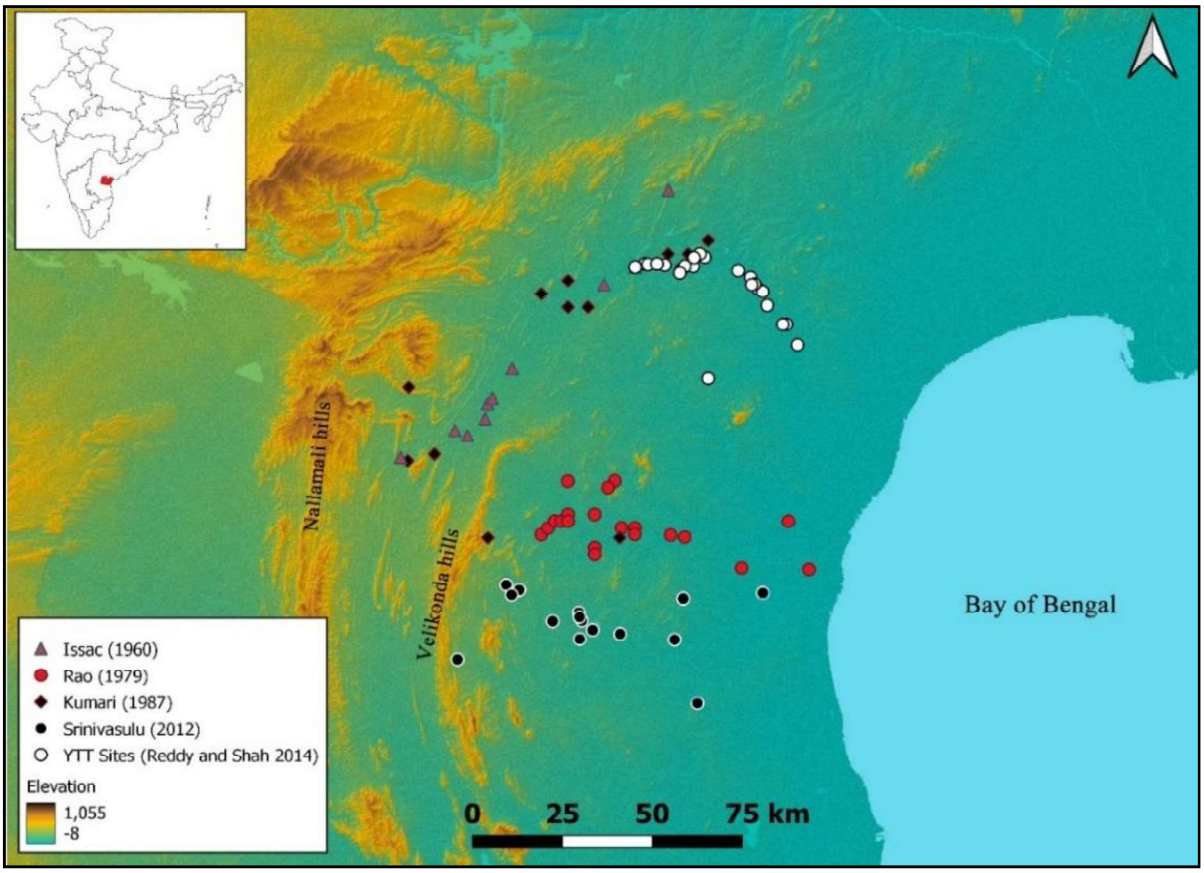
Prehistoric studies in this region were initiated by Robert Bruce Foote in 1875, who reported a few Lower Palaeolithic tools from the Manneru River (c.f. Rao, 1979). Ra (1979) examined the Paleru river valley in the late 1970s, reporting 16 Palaeolithic sites spanning from Lower to Upper Palaeolithic cultures. His surveys were primarily concentrated in the valley's middle reaches. The Middle Palaeolithic sites were particularly notable owing to the great density of artefacts (Rao, 1987). His findings revealed either a transition from the late Acheulian to the Middle Palaeolithic or that these two different technologies co-existed simultaneously. Geologists from the Geological Survey of India conducted Quaternary geological

investigations of the inland sand dunes in the basin's upper reaches (Mishra & Singaraju, 2009; Reddy et al., 2013). These dunes are 75 kilometres inland from the east coast and cover 500 sq. km. The dunes were also chronometrically dated, revealing that they spanned from contemporary times to 50 thousand years ago, implying a lengthy history of sand dune aggradation and reworking (Reddy et al., 2013).

Issa (1960) investigated a short stretch of the upper reaches of the Gundlkamma river valley in the 1950s and reported a few Palaeolithic sites. Thimma Reddy (1971) discovered the Upper Palaeolithic site of Yerragondapalem in this basin (c.f. Kumari, (1987)). In the late 1980s, Aditya Kumari investigated the Gundlakamma River and discovered sites from the Lower to Upper Palaeolithic phases. In addition, she discovered occupational floors from the Lower and Middle Palaeolithic phases (Kumari, 1987). However, the identifications mentioned above demand more examination. Recent surveys conducted by geologists from the Geological Survey of India in the Gundlakamma river valley have found animal fossils and Toba ash deposits, in addition to the vast potential for Palaeolithic material (Reddy & Shah, 2004). Their surveys led to the identification of Toba ash at 23 locations throughout the upper and middle reaches of the Gundlakamma River. In a few cases, these ash deposits have been found sandwiched between floodplain materials and resting directly on top of phyllites. The ash bed at Kothapalem, possibly the longest, stretches for 500 metres along the river, with a width of 100 to 150 metres and an average thickness of one metre. Extensive chemical analyses of volcanic ash found in various river valleys across Andhra Pradesh have revealed that it is co-relatable with the Youngest Toba Tuff (YTT) (Acharyya & Basu, 1993; Westgate et al., 1998), which was deposited around 74,000 years ago as a result of the eruption of Toba on the north-western part of Sumatra Island in the Indonesian Archipelago. Using chemical analysis, Reddy and Shah (2004) found that Toba ash from the Gundlakamma river is co-relatable with the Youngest Toba Tuff. Further, Reddy & Shah (2004) discovered fracture patterns in the ash deposits at Kothapalem, suggesting neotectonic activity, although more research is needed to verify the aforesaid proposition.

The Manneru valley has been a veritable ground for prehistoric finds. As mentioned earlier, R.B.Foote (1875) explored the banks of the Manneru river for the first time and could locate Acheulean artefacts at Ramapatnam, Kandukur, and Kondasamudram on the south bank and Lingasamudram, Irur, and Iskapalle on the left bank. Later, a detailed account of the finds was attempted (Brown, 1917). Recently Srinivasulu (2012) explored the Manneru valley and reported several Palaeolithic sites.

Previous research has indicated that the region's prehistoric habitation lasted from the Lower Palaeolithic through the Mesolithic/Mircolithic periods (Map. 2.3.1). Late Acheulian bifaces, choppers, scrapers, and other flake tools have been documented from the region, and Cuddapah quartzite was predominantly used to make these artefacts (Rao, 1979). Miniature handaxes, scrapers, points, borers, choppers, discoids, flakes, and flake blades were all part of the Middle Palaeolithic industry in the area (Kumari, 1987). Blades, scrapers, burins, points, borers, awls, knives, and backed pieces, among other things, are comparable to the well-known Upper Palaeolithic site of the region, Yerragondapalem (Srinivasulu, 2012). Issac (1960) noted microlithic artefacts made on quartz from the Gundlakamma river basin. This previous research shows the region's enormous potential for understanding Palaeolithic and subsequent behavioural evolution.



Map. 2.3.1: The distribution of Prehistoric and Youngest Toba Tuff sites in the study region.