CHAPTER 6

CONCLUSION

The preceding chapters presented the findings of multidisciplinary studies undertaken along the Gundlakamma and adjoining valleys with the goal of situating the region within the context of peninsular India's Palaeolithic archaeology and the global context. The study highlights the region's potential for understanding hominin behavioural evolution in regional and global contexts. The South Asian Palaeolithic record was thought to lack significant evidence in hominin evolutionary studies, mainly due to the absence of hominin fossil records, a robust chronological framework, and associated paleoenvironmental reconstructions. However, more recent studies by Petraglia et al. (2007), Pappu et al. (2010), Mishra et al. (2013), and Akhilesh et al. (2018) have highlighted the significance of South Asia in human evolutionary studies. Following on from these studies, the current research explores the crucial role of the South Asian Palaeolithic record in understanding human behavioural evolution. Further, the study emphasises the complexity of the region's Palaeolithic record, which challenges and calls for a re-evaluation of the region's current human evolutionary framework. The research focused more on generating chronometric ages for the palaeolithic remains recovered from secure geological contexts, which are crucial in addressing general issues in South Asian Palaeolithic studies highlighted in the Sections 1.1 to 1.4 of Chapter 1.

Intensive surveys were conducted in the study region to locate stratified palaeolithic sites, followed by a systematic investigation of seven sites representing a broad temporal range including the Middle and Late Pleistocene. The current research marks the first attempt to use chronometric dating methods to reconstruct a regional Palaeolithic cultural sequence and to use the new data to address general issues in regional Palaeolithic studies in peninsular India. Multidisciplinary approaches involving excavations, luminescence chronology, U-series dating, geoarchaeology, geochemistry and faunal analysis were adopted in the current research to situate the Palaeolithic record of the region under investigation in the broader regional and global context. Further, the high-resolution lithic analysis combined with statistical analyses of various attributes of lithic artefacts were conducted in this research. The lithic analysis, coupled with chronometric ages, offered significant insights into understanding the variations and similarities of the lithic technology through time.

The explorations undertaken in the region under investigation led to the discovery of 68 Palaeolithic sites associated with different geological and cultural contexts. These sites represent different phases of the Palaeolithic culture including Lower, Middle and post-Middle. In addition, sites with Youngest Toba Tuff (YTT) deposits from the 74 ka Toba super-eruption were identified in the region. The Middle Palaeolithic cultural remains constitute the most dominant amongst the diverse cultural assemblages and represent a broad temporal range from ~247 to 59 ka. Sites showing post-Middle Palaeolithic cultural remains are the second dominant category and are mostly concentrated along the upper reaches of the Gundlakamma and Manneru river basins. The Lower Palaeolithic sites are mostly known from findspots and riverbeds with a small number of stratified localities. This could be due to the lower exposures of Lower Palaeolithic horizons, which are associated with hard and compact sediments that are buried deeply under Late Pleistocene sediments. Several microlithic sites associated with inland sand dunes were also discovered during this study, however, the geological and chronological context of these assemblages are not discussed in this work.

Lithic assemblages having features of transition from the Late Acheulian to Middle Palaeolithic are identified in this research. Typo-technological analysis of these assemblages indicates the presence of both the bifacial and prepared core reduction techniques being practised, the latter being more dominant. Preferential surface cores which are seen as a precursor to later Levallois technology were also observed to be present in these transitional assemblages along with definite evidence of projectile artefacts. These transitional assemblages collectively indicate a greater preference towards flake-based artefacts where the flakes are produced through prepared core technology with the possible presence of hafting evidence. Such evidence is regarded as a characteristic feature of African and Eurasian Middle Palaeolithic/Middle Stone Age culture (Foley & Lahr, 1997). It is difficult to ascertain the chronological framework of these assemblages due to the saturation of Luminescence signal of feldspar grains in the sediments from A. Agraharam and Nandanavanam. However, a minimum age of ~ 400 ka can be estimated for the final burial of these assemblages. Interestingly, the emergence of flake based Middle Palaeolithic culture in Africa and Europe is chronologically dated to ~ 400/300 ka (Adler et al 2014; Deino et al 2018; Akhilesh et al 2018), which is close to the estimated period from A. Agraharam and Nandanavanam. Further, the early Middle Palaeolithic assemblages from Attirampakkam, also dated to 380 ka, indicate that at least in this part of South Asia, the Middle Palaeolithic culture existed as old as ~ 400 ka. The reasons for the appearance of this technological convergence in different geographical regions associated with

different hominin species dating to ~ 400 ka are yet to be investigated. Investigating the aforesaid phenomena will certainly change our perspectives on hominin behavioural evolution.

Middle Palaeolithic assemblages from Hanumanthunipadu (>247 ka (Anil et al 2022)), Retlapalle (145 ka), Vemulapadu (105 ka) and Motravulapadu (59 ka) shed significant light on the evolution of Middle Palaeolithic culture in the region. These four sites, dating from the late Middle Pleistocene to Late Pleistocene epochs, are crucial to examine the changes and similarities in Middle Palaeolithic culture through time. Variations in the relative abundance and absence/presence of specific tool types are observed between the late Middle and Late Pleistocene sites. However, quantitatively no significant changes are observed in the Levallois core technology between sites dating to the late Middle and Late Pleistocene. All these pieces of evidence indicate the indigenous development of Middle Palaeolithic culture in the region, which continued at least until 40 ka. The South Asian Middle Palaeolithic culture was associated with modern human populations migrated from Africa between 120-70 ka (Petraglia et al 2007). The current research suggest that the Middle Palaeolithic in South Asia existed way before the timing of Eurasian migrations of modern humans. In addition, technological convergence, and similarities in the lithic technology of diverse hominin groups have also been noted in Levant (Shea, 2008) and Indonesian sites (Moore et al., 2009). Therefore, Middle Palaeolithic technology alone cannot be used to assess the dispersal and spread of modern humans.

The chronological and technological characterisation of post-Middle Palaeolithic cultural remains done in this current research fills major gaps in our understanding of the Late Palaeolithic framework. The Late Palaeolithic framework of South Asia denotes the overlap of microlithic assemblages dating to ~ 50 ka and late Middle Palaeolithic dated to ~ 40 ka. Even though several sites show the presence of blade-based assemblages (Upper Palaeolithic), no chronometric ages are available to understand the place of these assemblages in South Asian Palaeolithic sequences. The Late Palaeolithic term ignores these blade-based assemblages and attributes them as a part of late Middle Palaeolithic toolkit (James and Petraglia, 2005; Blinkhorn and Petraglia, 2017). The current study reports systematic production of blade artefacts dated between 41 to 29 ka indicating the existence of this technology for ~ 10 k as a distinct temporal behaviour. Typo-technologically, these assemblages are distinct from the Middle Palaeolithic and Microlithic assemblages, but they temporally overlap. This indicates the complexity of South Asian Palaeolithic record and opens new avenues for further investigations.

The current study demonstrates a broadly continuous pattern of sedimentation with in the Gundlakamma basin during the Late Pleistocene that has seen limited disruption despite the YTT eruption and deposition of tephra across the landscape. Within 10 ky of the eruption, reworking of YTT appears to have ceased with the return to a pattern of sedimentation that is comparable to those preceding the eruption of Toba, re-established by ca. 64 ka. Direct dating of sediment deposits over- and under-lying the YTT horizons enables the examination of trajectories of change in hominin behaviour in response to changes within this landscape. This suggests a pattern of continuity that is consistent with wider regional evidence for the persistence in the use of Middle Palaeolithic technologies in South Asia spanning the eruption of Toba. However, YTT beds from Motravulapadu (Trench 2) constrained with OSL ages of 33 and 29 ka indicates redeposition of the ash after ~ 30 ka of the Toba eruption. Such later redeposition are also observed from other sites in South Asia suggesting that complex history of depositional and re-depositional processes of YTT beds in South Asia. The current research further highlights the risks of using the YTT beds as chronological marker in reconstructing the palaeoenvironments and hominin behaviour in South Asia.

The region of South Asia encompasses various ecologies ranging from tropical rainforests to grassland and deserts. This ecological diversity may have encouraged the sustenance of an extensive range of animals, although not much research on Pleistocene faunal population changes has been carried out in the region due to the lack of stratified finds. South Asian ecosystems are sensitive to the Indian Summer Monsoon, and the region is one of the first regions to be occupied by modern humans. Human impact on animal populations in regions beyond South Asia has been extensively addressed, but the impact on South Asian faunal populations and the consequences of the 74 ka Toba volcanic super-eruption is poorly known. Therefore, South Asia presents a critical but poorly documented region for investigating faunal responses to climatic, volcanic, and anthropogenic changes during the Late Pleistocene. The major issues with the fossil studies in South Asia are the lack of stratified finds and absolute dates. In regions where open-air sites are abundant, faunal preservation is very poor due to the complicated depositional history of the Pleistocene sequences, and the various taphonomic processes which influence the mode of deposition of the fossil assemblages. This could be due to inadequate burial, carnivores and scavenger feeding patterns, or human social practices of food processing and waste disposal. However, several occurrences of the Late Pleistocene faunal remains from mostly surface contexts and a few stratigraphic and dated contexts are reported in South Asia.

In this background, the faunal assemblage recovered from Motravulapadu representing the Late Pleistocene epoch provides unique context to understand the faunal responses to climate, anthropogenic and volcanic driven changes. The mammalian taxa in the faunal collection are predominantly represented by medium to small-sized bovids, except the horse and cattle, which are also well adapted to the semi-arid environment. The presence of monitor lizard is indeed a unique discovery hitherto not reported from the Pleistocene vertebrate localities in Peninsular India. These carnivorous reptiles are represented by three species and have a pan Indian distribution, inhabiting in a wide range of habitats like forests, deserts, marsh, rivers, and tidal creeks. Their diet includes small mammals, birds, and their eggs etc. However, its occurrence at Mortavulapadu is a first report and merits a detailed study of its ecology, behavioural biology, and microstructural study for reconstructing palaeoenvironmental conditions of the site. The complete absence of elephants, hippos, rhinos and buffaloes and molluscs is unusual to a Pleistocene fossil locality but also provides vital cluses to the habitat that afforded small-sized bovids and other taxa. Isotope and microstructural proxies from bones and teeth will help in giving precise resolutions about palaeodiet, ecology, rainfall, palaeopathology and developmental biology of these animals.

The Palaeolithic record of Gundlakamma and adjoining river basins adds significant contributions in understanding the hominin behavioural evolution in South Asia and fills major gaps in our knowledge of the same (Fig. 6.1).

6.1 Limitations and Future Scope of the Current Research

The current research focuses on seven temporally and spatially distinct Palaeolithic sites by approaching them with multidisciplinary methods including excavations, Luminescence and U-series chronology, geoarchaeology, geochemistry, and Palaeontology. These sites were selected based on their rich artefact presence, good preservation and expected to represent broad temporal range to build the cultural sequence of the study region. The study recognises the biases towards selecting these sites and potentially overlooks the spatial variation of the sites. To increase the artefact sample size, systematic grid collections were conducted from six sites which may influence the overall composition of the assemblage and frequencies of artefact types. However, these sites contain single techno-cultural artefact bearing horizons that potentially excludes the temporal mixing of the artefacts and eliminates the sites being palimpsest. The Luminescence method was unable to date the older sediments due to the signal saturation in feldspar and quartz grains.

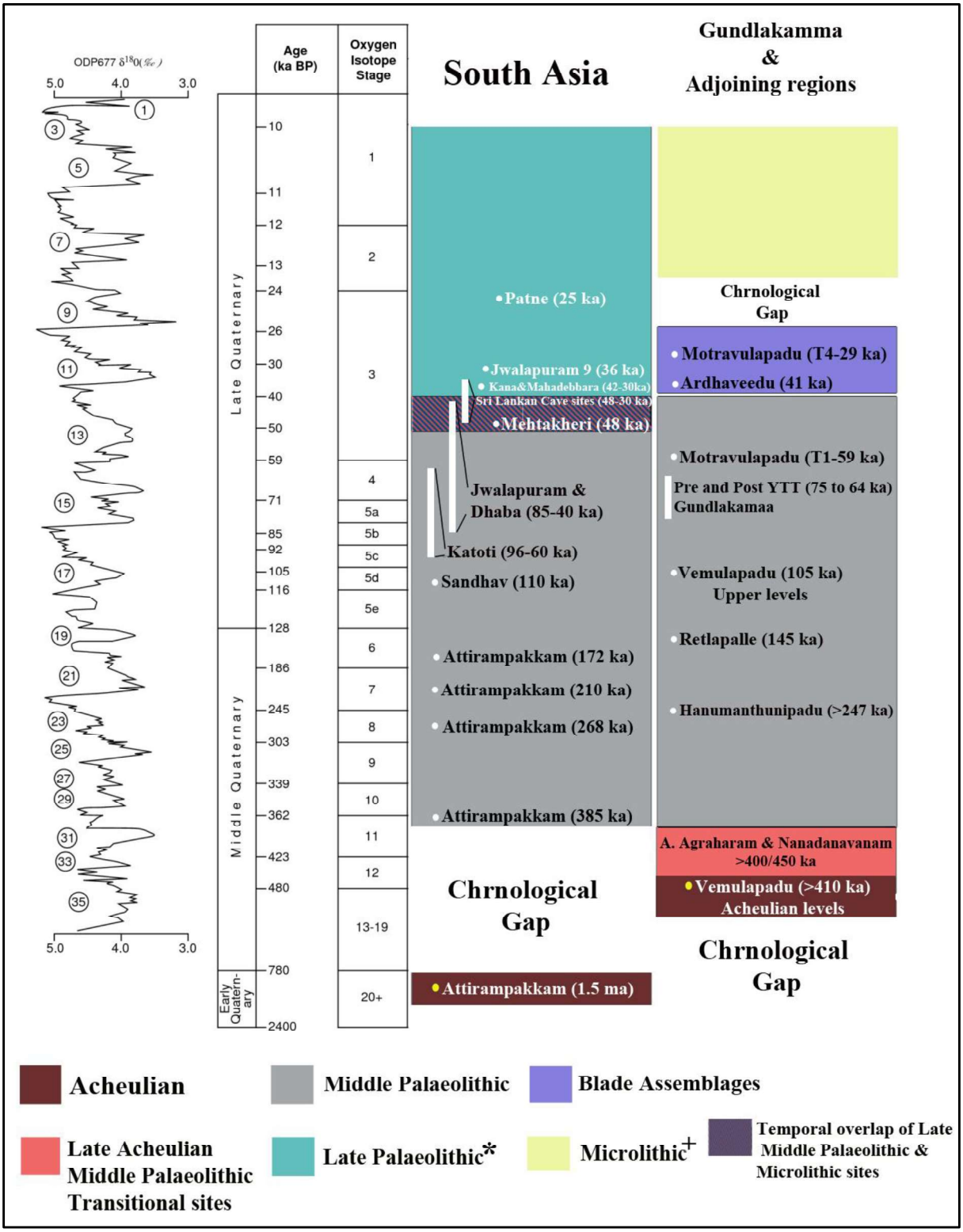

Figure. 6.1: Comparison between the Pleistocene cultural developments in South Asia and current study region. Sites with firm chronological framework and secure geological context are shown here and other sites with chronometric ages are considered in the overall temporal range of the different cultural phases.

*The term Late Palaeolithic here represents the post Middle Palaeolithic cultural developments in South Asia adapted from (H. V. A. James & Petraglia, 2005). This term

is widely used currently in South Asian Palaeolithic research that represents the temporal overlap of microlithic and blade based (Upper Palaeolithic) assemblages in the region. However, due to the lack of secure chronological and stratigraphical context of the Upper Palaeolithic assemblages, these are seen as part of late Middle Palaeolithic assemblages (Blinkhorn & Petraglia, 2017; Clarkson et al., 2020) rather than disticnt temporal behaviour. In contrast the current study identified the blade based assemblages as stratigraphically and technologically different from Middle Palaeolithic and microlithic assemblages.
#The age estimations for the microlithic assemblages for the region are adapted from (D. V. Reddy et al., 2013).

The current research stresses the need for further investigation of these sites aimed at large scale excavations, other chronometric methods to date older sediments which can add significant insights into the South Asian Palaeolithic record. Paleoenvironmental reconstructions using sediments associated with artefacts and faunal remains are further needed to assess the role of climate in shaping the hominin behavioural evolution. As the region presents unique situations such as the presence of YTT deposits, Acheulian to Middle Palaeolithic transitional sites, and Palaeolithic assemblages spanning crucial events of climate change, paleoenvironmental reconstructions can provide important information on human cultural and past environmental relations in a broader perspective. Further investigating the microlithic/Mesolithic assemblages associated with inland sand dunes in Paleru valley and other sediments in Gundlakamma and Manneru valley can provide significant insights on the post 30 ka cultural developments in the region.