Quarry) were discovered along a non-extruding dolerite dyke. This dyke contains fine-grained dolerite that appears to have been targeted by Neolithic axe-makers. Fracture patterns in the dyke appear to have in some cases created stone slabs ideal for axe production purposes. Limited test trenching of the Upper Quarry and investigations at the Lower Quarry suggest that while preliminary reduction was carried out at the quarry sites, axe blanks were subsequently transferred to localities like that investigated in Area A for further reduction and grinding. Exposure of a section of dolerite several hundred meters in length at the Lower Quarry as a result of modern granite quarrying activities revealed prehistoric mining pits along the entire length. These were in-filled with quarry spoil as well as occasional hammerstones and lithic debitage. The dyke therefore appears to have been the focus of intensive dolerite quarrying efforts, and much of this activity may be hypothesised to date to the Late Neolithic/early Megalithic period, when intensive more specialised axe production was taking place at the site. Also found at the Upper Quarry site as well as various other localities at Hiregudda was evidence for prehistoric quern production from local granite outcrops. A human skeleton exposed by recent quarry blasting was also discovered in Area B, in association with the quarry site. Excavation was carried out to rescue the remains, which were eroding out of the hillslope. Preliminary assessment suggests the burial dates to the later prehistoric or possibly historic period. It consisted only of the remains of an adolescent female unaccompanied by burial goods.

Other investigations at Sanganakallu-Kupgal

Other work at Sanganakallu focused on systematically recording rock art, ringing rocks and grinding grooves. Grinding grooves are ubiquitous at Southern Neolithic sites, and are found on bedrock and boulders on all the Sanganakallu-Kupgal hills, but particularly those associated with more intensive prehistoric habitations. Many new rock art sites were located, in addition to several new ringing rock sites. All of the ringing rocks discovered so far have been found at Hiregudda, and the majority occur on dolerite. Two large banana-shaped ringing rocks were discovered in association with a stone circle in Area D of Hiregudda. These appear to have been carried down from the nearby dolerite dyke, and were found symmetrically situated on the periphery of the circle.

Area D appears to have functioned as an area of non-intensive occupation in the later Neolithic and/or early Megalithic period. Section scraping and associated test-trenching in an area disturbed by modern quarrying revealed several late Neolithic infant urn burials in Area D. Stone features investigated here and elsewhere suggest that terrace-like features date to the Neolithic, and had a primarily habitation-related function. They seem to relate to stone-clearing activities and the creation of enclosed habitation and/or animal stabling areas. Many of the stone features occur on bedrock, and seem to have led to the gradual build-up of sedimentary deposits that has led to the appearance of a system of terraces. However it should be emphasised that investigations to date have been limited, and an agricultural function for some or all of the terraces cannot presently be ruled out. One possibility that should be borne in mind is the re-use of the terrace features at a later date, once sediment had accumulated, for agricultural purposes.

Limited test trenching was also carried out at the Birappa rockshelter on the plain to the north of Hiregudda. This work indicates that the shelter primarily functioned as a locality for the production of microlithic blades from locally-obtained quartz pebbles. This type of production can be traced back to a pre-ceramic period, and may have continued into the historical period. Charcoal samples collected during flotation of sediments from the site were radiocarbon dated, and some gave pre-Neolithic dates (see Table 3). Unfortunately, these dates do not arrange into an appropriate stratigraphical order. This is perhaps not surprising in light of the small size of the charcoal recovered during flotation (fragments were all under 2 mm in diameter), and the overall thinness of the deposits at the site. Movement of small charcoal fragments is likely to have been affected by the local bioturbation processes revealed during excavation. Nevertheless, the early dates must relate to human activities, which included fires at the site as early as 9000 BC, with occupational episodes also indicated for ca. 4300 BC and ca. 3500 BC. In combination with the absence of ceramics in the early levels of the site, the early dates suggest initial occupation of the site and associated quartz reduction activities date to the early and mid Holocene. This fits with the notion of a pre-ceramic Mesolithic occupation proposed by Sankalia on the basis of excavations at a similar microlithic-rich locality in the area (Sankalia 1969), and finds its parallel in a pre-ceramic, quartz flake-dominated industry in the lowermost granite gruss horizon at Sannarachamma (see also Subbarao 1948). Later dates from Birappa suggest sporadic later activities at the site, in the late Neolithic/early Megalithic (1400–1200 BC) and early historic periods. This is not surprising given the evidence for continued activity at the rock shelter associated with its use as a local shrine (see Boivin 2004b).

The animal bones

Preliminary analysis of the animal bones from Sanganakallu-Kupgal suggests the presence of a range of species, both wild and domestic, in keeping with findings at other Southern Neolithic sites (Korisettar et al. 2001a,b; Paddayya et al. 1995). Cattle, along with sheep and goat, dominate the domestic assemblages from all sites in the Sanganakallu-Kupgal area. Interestingly, however, sheep and goat appear to be more common than cattle in domestic contexts, and cattle bones bore a smaller percentage of cut marks and cooking burns than the bones of sheep/goat. This suggests that contrary to the assumptions of previous workers (Paddayya 1975; Thomas & Joglekar 1994; Korisettar et al. 2001a: 191), cattle did not form the mainstay of the everyday diet during the Neolithic. While the large quantity of cattle bone, combined with the quantity of accumulated dung attested in the ashmounds provides clear evidence for the importance of cattle pastoralism during the Southern Neolithic, the results from contextual animal bone studies at Sanganakallu-Kupgal suggest that this may have had an important symbolic and prestige component. Indeed, the creation of virtual 'monuments' out of cattle dung (Boivin 2004a; Boivin et al. 2002; Johansen 2004), the deliberate burial of cattle skulls and bones (Paddayya et al. 1995), and the focus on cattle motifs in Southern Neolithic rock art (Allchin & Allchin 1994–95; Boivin 2004a) suggest a symbolic or social emphasis on cattle that is very much in agreement with these archaeozoological findings. Certainly this would not conflict with ethnographic observations of present-day cattle pastoralists, who often reserve the killing and eating of cattle for important ceremonies and rituals (for example, see Evans-Pritchard 1940). It may be that cattle-eating was something reserved for special occasions, such as the feasts that appear to be attested at sites like Budihal (Paddayya et al. 1995). Cattle were likely prized animals whose economic and social value extended well beyond their nutrient value, and they may well have been traded between Neolithic groups, perhaps at the social gatherings that have often been inferred to have occurred at ashmound sites (Allchin 1963; Boivin 2004a; Fuller 2001).

The faunal analysis has also indicated interesting differences between bones from different sites and also different contexts at Sanganakallu-Kupgal. Cattle (and cattle-sized) remains were significantly less common at the Birappa rockshelter than the other sites, suggesting, in concert with other evidence, a different use of the site. Cattle bones appear to be in highest proportion at Sannarachamma, and this seems to be due to their dominance in ashmound deposits. Analysis of ashmound deposits from Sannarachamma indicates that they contain more bones from cattle and cattle-sized animals than do other kinds of contexts. In addition, the range of species represented in ashmound deposits appears from preliminary analysis to be lower than other contexts. This suggests that ashmounds were not generalised garbage dumps, and that they may indeed have been associated with very particular kinds of depositional activity. It is also of interest that bones from ashmounds tend not to bear cutmarks, and the small percentage that do are predominantly from sheep-sized animals. Bones found in ashmound layers also, surprisingly, do not usually exhibit signs of burning. When burning evidence is found, it appears to result from cooking, rather than intense or prolonged exposure to high temperature burning. This is of significant interest in terms of ashmound formation processes, since it suggests either very low temperature burning (a possibility at Sannarachamma, where no vitrified deposits were encountered), or mixing of the bone with the ash only after burning. This might indicate redeposition of ash deposits from the context of burning, though the stratigraphy does not seem to support such an interpretation.

The struck lithics

The lithic assemblage from Sanganakallu-Kupgal is representative of what is generally known of the Southern Neolithic (Korisettar et al. 2001a: 175–79), although detailed technological studies have been few. There are two major and quite distinct components of lithic production. First there is a struck lithic industry on crypto-crystalline rocks, including cherts and quartz (comparable to that studied from Watgal by DuFresne et al. 1998). This first component can be studied to assess continuities and differences from earlier "Mesolithic" traditions in the region. Second, there is the characteristic "Neolithic" component, consisting of a groundstone industry, in particular of axes and related forms made of dolerite (for a previous study of this region's groundstone industry, see Allchin 1957). The former is more abundant at Sannarachamma hill and the latter at Hiregudda, particularly in the upper layers.

The struck lithic industry is based on a microlithic technology with a bladelet end-product modified by lateral retouch into geometric tools, principally lunates and backed bladelets. The main raw material in the upper levels at Sannarachamma is a micro- to crypto-crystalline silica broadly classified as chert. The chert is principally light brown in colour although some darker red chert is also present. Many flakes and blades are red chert at one end and brown chert at the other, suggesting that the source for the red and brown cherts is the same. Chalcedony with an orange cortex is also present in smaller quantities, along with white/milky white quartz and rock crystal. A few cores have been recovered from the site, indicating that the manufacture of bladelets probably took place at the site, at least in the latest phase of occupation. The bladelets are extremely thin and narrow suggesting that the pressure debitage technique was used in the final stage of production. Given that copper is limited in the Southern Neolithic, the likely indentor was either antler or horn, both of which would have been available from wild and domesticated fauna. Cortical flakes are rare, suggesting that cores or nodules were imported, perhaps having been roughed out at source. Broken bladelets and tools seem to be of a consistent size and may therefore have been deliberately snapped in preparation for retouching or hafting.

In addition to the chert bladelet industry, a number of quartz flakes were recovered throughout the occupation levels, but particularly from the earliest phase of occupation at Sannarachamma. No chert artefacts were recovered from this early deposit, and quartz artefacts were numerous. The distribution of these raw material types is striking when quantified stratigraphically (see figure 15). The quartz industry is flake-based, although there are a few bladelets, some of which have been modified into lunates. Thus it appears that quartz was used initially as a raw material for the lithic industry, to be replaced by chert. Previously it was thought that there were no major local chert sources, and that the chert raw materials in this region were imported from areas to the north such as the Raichur and Shorapur Doab (Korisettar et al. 2001a: 177; Fuller 1999). Recent reconnaissance, however, indicates the presence of local chert deposits in the banded iron formations of the Sandur greenstone belt, which are significantly closer. Interestingly, this transition from quartz to chert sources appears to occur with the depositional transitional from ashmound deposits to "normal" occupational deposits.

The flaked and ground dolerite industry

Hiregudda, with its abundant dolerite, was a location for the intensive production of dolerite tools, at least some of which were finely finished as ground and polished axes. Foote (1916) has already identified this site as a "factory" for axe production, and its importance as a centre for production was further discussed by Allchin (1957) and reviewed in Korisettar et al. (2001a). Axe production, as indicated above, appears to have focused on specific localities on Hiregudda, and a large workshop area has been identified in Area A. As indicated, there is some evidence also for spatial segregation of axe production steps, with initial roughing out taking place at quarry sites prior to further shaping in Area A. While some grinding of axes was carried out in Area A, other larger-scale axe grinding localities have been found away from the area, and particularly at the base of Sannarachamma hill. Other axes may have been ground much further afield, if Hiregudda axes were being traded to neighbouring and other groups, as has been hypothesised (see below).

Analysis of the reduction strategies employed in Area A suggests that three main methods of axe production were used by knappers at Hiregudda (for a detailed discussion, see Brumm et al. forthcoming). These vary in terms of technological complexity and the size and shape of the clasts they were directed at. It is of interest that contextual analysis of the lithics debitage indicates that the most technologically-demanding axe reduction strategy is employed predominantly during the final phase of occupation of Area A. This strategy demanded large clast sizes that would certainly have involved more intensive quarrying of the dolerite at Hiregudda. This, along with evidence from Feature 1 in Area A (discussed above) suggests a shift from more domestic-oriented to specialised axe production, possibly within the context of a developing axe trade. Trade of axes is hypothesised on the basis of the evidence for a shift towards more intensive, specialised axe production in Area A during the final phase of occupation of the site. This would fit with a picture of intensified overall trade activity, as indicated for example by the gradual increase in copper finds in upper levels at Hiregudda. Axes may have been implicated in broader trade networks that encouraged craft specialisation and the eventual emergence of elites at the tail end of the Neolithic or early Megalithic period. In this regard, it is of interest that the site of Budihal bears evidence of axe-grinding but no associated axe production industry (Paddayya 2000–01: 198). Axes from sites rich in high quality dolerite, like Hiregudda, may have circulated to areas lacking appropriate material, and the final intensive grinding of such axes may well have taken place at other sites.

Towards an improved understanding of the ceramics

Some 2000 kg of pottery have been collected during the course of work carried out by the Sanganakallu-Kupgal Project (much of it from the collapsed trench fill of previous excavations, which was thoroughly sieved), and analysis of this material is ongoing. A few salient conclusions and key aspects of variation will be highlighted here. First of all, it is clear that 'Neolithic' ceramic types, handmade and often burnished, persist throughout the history of these sites, while 'Megalithic' types, characterized by being wheelmade, often slipped, and sometimes polished, begin to occur in later levels. These observations confirm those of Devaraj et al. (1995) that Megalithic ceramics emerged during the Late Neolithic, and represent technological developments upon the Neolithic potting tradition, perhaps to be associated with the emergence of more specialized production. In general, this transition appears to date to ca. 1400–1300 BC. A very small number of wheelmade sherds were found in earlier contexts, but might prove to be intrusive.

The ceramics from Sannarachamma and Hiregudda are similar and can be related to Ashmound Tradition Phase III and the Neolithic/Megalithic transition. As evidenced at Sannarachamma in particular, there was an increase over time in slipped or washed types over simple burnished types. In addition, later Neolithic forms often have a 'crackly' surface, because the coating contracted at a different rate than the body clay of the vessels, a trait of the later Neolithic ceramics noted by Allchin (1960). Forms are predominantly open bowls and open-mouthed jars with everted rims, but a smaller number of other forms are also present, most of which are associated with the later Neolithic, especially Phase III, such as spouted forms, perforated bowls, and jars with necks and narrower mouths. Variants of most of these forms (with the exception of perforated bowls) are transferred to wheel production in the Neolithic/Megalithic transition phase. Painted sherds and sherds decorated with incised/impressed designs were rare.

Of particular interest is the wide range of fabrics represented amongst the present material. By fabric, we mean the characteristics of body paste, in terms of colour and texture, as well as non-plastic mineral inclusion types that are visible under low magnification (e.g. x10) on sherd sections freshly fractured after retrieval. Although only a preliminary study of small fraction of the assemblages has been completed, it is clear that the Neolithic assemblage from these sites contains a remarkably wide range of fabrics. Eleven recurrent fabrics for handmade forms were identified, most including various frequencies of quartz (or sand), mica and fine black mineral inclusions. Some fabrics also included calcareous opaque white inclusions, although these were uncommon. This can be contrasted with recent examinations of Kurnool District Neolithic pottery (unpublished data), where mica is largely absent, and both calcareous inclusions and grey and brown limestone fragments are frequent. These broad regional differences are clearly attributable to underlying geology, and it seems possible to infer that distinctions within assemblages are also due to variation between clay sources. While all of the above inclusions may occur naturally in gathered clays (although addition of quartz sand seems likely for certain fabrics), some fabrics included grog-temper, which derived from crushed particles of other pottery.

What the fabric variation suggests is that superficially similar pots were produced from a range of sources, probably by various Neolithic communities, and then exchanged between these communities over short distances. Interestingly, the labour-intensive practice of burnishing these ceramics suggests that most or all potters sought to obtain shiny surface finishes (while roughened and unburnished pottery may have been produced to meet particular functional requirements). The exchange of superficially similar, carefully produced pottery across sites, such that a set range of shapes but wide diversity of fabrics may be found at any particular Neolithic site, suggests the operation of social exchange networks, such as through kinship, in which importance was invested in the act of exchange rather than the commodity per se. This pattern can be contrasted with the more specialised production patterns of later periods, when fabric varieties decrease, as with the polished, wheelmade black-and-red ware ceramics of the Megalithic period.

Also of note are aspects of ceramic preservation that can be related to the nature of site occupation. For example, sherds from the surface and upper layers at Hiregudda Area A were heavily abraded and surface layers were often largely worn off. Similarly abraded sherds were noted in the lowest gruss deposits at both Hiregudda A and Sannarachamma. It is seems likely that the abrasion is due to exposure, presumably from being left on exposed hilltop surfaces during periods without substantial sediment build-up and occupation. The abraded sherds at Hiregudda A might therefore be related to a hiatus in occupation, tentatively placed at 1500–1400 BC, as well as perhaps sporadic or seasonal use for specialized axe production. At Sannarachamma, in contrast, where there is no apparent hiatus, abraded sherds are by and large absent. The few abraded sherds in the lowermost gruss-sand deposits might relate to an earlier, more mobile phase of the Neolithic.

Also of interest amongst the ceramic material were finds of edge-ground potsherds. While edge-ground sherds, sometimes in recurrent shapes, were found throughout the deposits, perforated and rounded edge-ground sherds that can be considered spindle whorls are only know from the later levels of both sites. This suggests that the spinning of fibres for textile production was a development that occurred sometime during Ashmound Phase III and probably intensified towards the Megalithic transition, in the later half of the second millennium BC.

Agricultural and environmental evidence

Archaeobotanical samples were collected through flotation from nearly all contexts and from all investigated localities, trenches and phases. Samples were processed using simple bucket flotation, in particular the wash-over method. This consisted of adding filtered water to the sediment in a bucket, mixing it, and then pouring it into a 500 micron sieve bag to collect the flot. Once all the flot had been collected, the heavy fraction left in the bucket was passed through a 2 millimetre sieve to retrieve any artefacts and heavy environmental remains. In total, about 350 flotation samples have been collected, accounting for the processing of nearly 5500 litres of sediment.

The current work augments earlier research conclusions regarding Southern Neolithic agriculture (Fuller 1999; Fuller et al. 2000–01, 2001, 2004; Korisettar 2004). In particular, four key conclusions of this earlier work appear to be confirmed by the Sanganakallu-Kupgal evidence available at present: 1) the predominant crops throughout these sites are the 'basic Neolithic package' of south India, consisting of Browntop millet (*Brachiaria ramosa*), bristly foxtail (*Setaria verticillata*), mungbean (*Vigna radiata*) and horsegram (*Macrotyloma uniflorum*); 2) although all of these species are wild in parts of peninsular India (Fuller 2002; Fuller and Korisettar 2004), there is no evidence for their domestication in the Ashmound Tradition region, including Bellary District, and all sites sampled so far preserve evidence for established cultivation rather than the transition from foraging; 3) winter cereals of Near Eastern origin (wheat and barley) were present by the early second millennium BC, and from the beginning of Neolithic occupation at Sannarachamma, and these species must have been adopted from the north via the earlier Deccan Chalcolithic; and 4) crops of African origin are still fairly insignificant in the Southern Neolithic, but begin to be adopted in the region ca. 1500 BC, especially the hyacinth bean (*Lablab purpureus*). At Sannarachamma, hyacinth bean is prominent in the levels which include wheelmade 'Megalithic' pottery.

Previously, a simplified settlement-scheduling model was proposed (Fuller et al. 2001; Fuller 1999, 2001), and this requires testing and refinement. This model was based on inferred patterns of cultivation, as well as general differences between sites in terms of their types of deposits. It was also hypothesized that this pattern was reflected in the distribution of grinding stone (quern and mortar) features across the landscape and amongst sites. The seasonality of the major recurrent crops is monsoonal, with sowing in perhaps late June or July, and harvesting between late September and early November. Wheat and barley, by contrast are post-monsoonal, being sown in November or December, with harvest in March or April. During the monsoon agricultural season, we therefore expect the population of the Sanganakallu-Kupgal sites to have been at its peak, as it was at this time of the year that the staple foods were produced. Wheat and barley, in contrast, may have been grown on a smaller scale by a subset of the community, though they would have required tending and probably also labour-intensive irrigation. The presence of dry season gathered fruits, and possibly tubers, which might also be dry season harvested, might also indicate that at least some portion of the population lived at the sites year-round. It is during these drier months, from November onwards, when ceramics must also have been produced.

Nonetheless, some of the regional population must have moved to other ashmound sites at points during the year, and it has been suggested that this is most likely to have occurred during the dry season, when water stress would have been most extreme, and imposed limitations on the support of grazing herds (as already suggested by Allchin 1963). Thus isolated ashmounds, like Kudatini, Toranagallu, Sanavaspur (west of Bellary, south of Kurugodu) or Halakundi (south of Bellary) were suggested to be festival or ritual sites for the gathering of a transhumant populace during the dry season, broadly running from January through June, but perhaps focusing on April–May. Archaeological evidence in support of this scenario includes the absence at ashmound sites of the deeper grinding impressions with rounder profiles that are a recurrent feature of more permanent hilltop village sites, like Sannarachamma and Hiregudda, and are likely to have functioned in grain dehusking. In contrast, flatter-profile quernstones and grinding impressions associated with flour preparation and final food preparation are found at ashmound sites as well (Fuller et al. 2001). The implication is that everyone was consuming ground seed foods, but certain stages of the processing were being carried out only near those sites where cultivation was practiced, namely the hilltop sites.

It should be noted that all of the above work has focused on the identification of food plants through seed remains. The bulk of all the samples, however, consists of wood charcoal, which represents the remains of the routine wood fuels utilized on these sites during the Neolithic. This in turn relates to wood availability, and to a lesser extent wood choice, and thus provides an indication of the surrounding wild vegetation and its exploitation by people tied directly to the archaeological time scale. One of the major foci of current and planned archaeobotanical research is the examination of this wood. This has required carrying out a substantial degree of basic background botany, which is will be addressed in a forthcoming publication (Asouti and Fuller, in press). Wood charcoal evidence so far confirms that the Bellary area was already a semi-arid dry scrub savannah by the Neolithic period, with woody vegetation dominated by spiny *Acacia* species and the non-thorny *Albizia*. This is in general agreement with climate-based reconstruction of the broad vegetation zones of Neolithic south India (Fuller 1999: Ch. 4; Fuller and Korisettar 2004; Asouti and Fuller, in press).

A few additional species have been identified, especially from the upper Neolithic/ Megalithic transition layers at Sannarachamma, that indicate the exploitation of other ecological zones. These include *Strychnos nux-vomica,* a poisonous wood of dry deciduous woodlands that is ethnographically known to be used for magical and medicinal uses, and sandalwood (*Sanatalum album*), a plant with well-known cosmetic and incense uses. Recovered charcoal has also led to the identification of fruits of Bengal madder (*Rubia cordifolia*), a small vine of moist deciduous forests (which would have been situated near the Western Ghats), which has roots that are traditionally used as a reddish dyestuff for cotton. This is of particular interest in light of finds of probable spindle whorls in these upper levels, suggesting some local production of textiles beginning in Neolithic Phase III.

Geological and hydrological perspectives

The geology of the region surrounding the Sanganakallu-Kupgal area can be broadly divided into two types: the Archaean granite batholiths and the greenstone belts. These two rock formations have generally controlled the evolution of geomorphological features in the region, and analysis of the distribution and location of Neolithic and later prehistoric sites with respect to their distribution reveals an interesting pattern. While later sites occur on both types of formation, the majority of Neolithic sites are associated with the granite batholithic landscapes. The association of ashmounds with the greenstone belts – as at the site of Kudatini – is also rare. All other known ashmounds are situated either atop the granitic hills or at their bases. Subbarao's map showing the location of Neolithic sites in the Bellary District (Subbarao 1948) clearly reveals that the sites cluster on the granitic landscapes, and also show a preference for hilltops traversed by the dolerite dykes.

This distribution pattern can in part be attributed to hydrology. It is likely that the water table in the Mid–Late Holocene was higher, and reached the surface where intruding dolerite dykes served as a barrier, giving rise to springs. Hence numerous springs were active on the inselbergs, more or less perennially, and facilitated the formation of surface water ponds and pools that dotted the pediment landscape. Such a network of environmental features facilitated agro-pastoral adaptations, and provides a context for understanding Neolithic developments at Sanganakallu-Kupgal. In addition, numerous patches of black brown soils on the plains around the Sanganakallu-Kupgal hills, some of them very shallow in depth, attest to the former presence of shallow water localities, while the deeper black soils are generally associated with greenstone bedrock. The latter are rich in clays and were primarily suitable for pottery manufacture.

The varieties of stone utilized by the prehistoric inhabitants of the Sanganakallu-Kupgal area include granite, epidote granite, greenstone, quartz, siliceous breccia, hornblende schist, steatite, slate purple, quartzite, hematite jasper, hematite schist, agate, carnelian, chert and local clays. The use of these varieties of rocks was also noted by Foote (1895). Our study is now attempting to clarify the sources of these various mineral resources. While granite, epidote granite, gneiss, and quartz can be sourced to the immediate neighbourhood of the sites, other types of stone appear to have been obtained from greenstone formations in the Sandur greenstone belt. This belt lies to the west of the Sanganakallu-Kupgal site complex, which is just one of a series of Neolithic sites located at a radial distance of 10–15 km from the belt.

The Sandur greenstone belt is best known today for its iron ore and manganese deposits, but it also contains a significant repository of volcanic clastics, metamorphosed sedimentary, and crypto-crystalline silica minerals like jasper, agate, and chert. The belt is composed of six different formations. The Deogiri Formation contains orthoquatzites, limestone and chert, while the Raman Mala Formation possesses banded ferruginous cherts (including banded iron formations). The banded ferruginous chert formations are host to deposits of secondary haematite. The Donimalai Formation is chiefly composed of volcanic and sedimentary rocks, and banded chert formations are common, ranging in thickness from 1–100 m. These include hematite-enriched types, magnetite, jasper, and pyrite-rich cherts, and non-ferruginous cherts, orthoquartzites and phyllite are also common. The Talur Formation is largely made up of metabasalts, though intercalations of banded chert, siliceous chloritic schist, and rhyolitic tuff are also common. The Vibhutigudda Formation, the youngest formation, includes all the above-mentioned silica types.

Conclusion

The Sanganakallu-Kupgal area is one of the richest and most significant prehistoric localities in India. While archaeological studies have previously been carried out in the area, most were conducted prior to the development of scientific studies in archaeology, and have focused only on very specific localities within a much wider and more diverse landscape of prehistoric remains. The current destruction of sites in the region therefore demands an urgent response such as that which has been mounted by the Sanganakallu-Kupgal Project. This project has focused on the creation of the first detailed map of topographic, geological, hydrological and archaeological features in the region, in association with the analysis of sections exposed by modern activities, and limited rescue excavation at sites that are shortly to be destroyed. It has revealed the existence of previously unknown ashmounds on the area's hills, and demonstrated the importance of Hiregudda as a major centre for groundstone axe production in the late Neolithic period. The project has also generated a series of new radiocarbon dates that are enabling the Southern Neolithic to be placed in a firm chronological framework.

The preliminary findings of the Sanganakallu-Kupgal Project suggest that the Neolithic in the southern Deccan was associated with a number of key economic, social and ritual changes. These included changes in craft production patterns, associated with the gradual emergence of craft specialists in such areas as ceramic and stone axe production. Widening trade networks are suggested by the increase in exotic copper objects over the course of the Neolithic sequences at Sanganakallu-Kupgal, as well as the introduction of foreign crops and plants. During the late Neolithic, the introduction of spindle whorls in association with the first finds of cotton (from Hallur) and fabric dying plants suggest the emergence of textile production. The replacement of ashmounds with megaliths as the primary monuments in the landscape at the tail end of the Neolithic signals wider ritual and cosmological changes. These various transformations were likely intimately related to the subsequent development of elite groups, regional polities and wider oceanic trade networks at the beginning of the Iron Age. Our project findings allow these crucial developments to be traced back earlier than ever before, demonstrating that they find their origins in changes that took place amongst the earliest agricultural societies in the south.

It is hoped that the Sanganakallu-Kupgal project may serve as a model for the development of strategies for cultural resource management in areas of India where accelerated development projects are occurring. Such a model would see the detailed recording of sites attended by the application of scientific studies and the investigation of a particular set of research questions and issues. It is also hoped that the project will raise awareness of the need to address site destruction by quarrying and mining activity. Rescue strategies in India have been directed predominantly towards sites that are to be submerged as a result of dam-building activities. Other types of development activities also destroy archaeological sites on a significant scale, however, and need to be met with more organised and systematic rescue efforts. Given the current rate of destruction of archaeological sites in India – still completely unquantified but clearly substantial – the targeting of pristine sites for excavation makes little sense. Without the implementation of more significant and holistic cultural resource management strategy within India, the chance to understand more about the origins and early development of societies on the subcontinent will be lost, not just to present but to all future generations.