



MEGALITHIC CALENDRLICAL KNOWLEDGE AND AGRICULTURAL PRACTICES: ASTRONOMICAL EVIDENCE FROM SOUTH INDIA

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Abstract

The field study provides a field-based record for examining the possible relationship between astronomical observation, calendrical knowledge and agricultural life in South Indian megalithic communities. The study documents megalithic alignments, menhirs, stone circles, cup-mark stones and burials at Mudumala, Murardoddi, Wargal, Hasmatpet and Nagarjunakonda, and examines their orientations with field drawings, compass and GPS observations, Sun charts, Star Dial observations and digital mapping. This paper focuses on the calendrical dimension of that evidence. Particular attention is given to the east–west alignments at Mudumala, observations made around the equinoxes, the movement of solar azimuth between seasonal extremes, the systematic arrangement of menhirs, and the Sun-chart comparison of different latitudes within Andhra Pradesh. the field study explicitly raises the possibility that some menhir arrangements functioned as a kind of calendar for identifying days, seasons, harvesting, festivals and other activities. The paper therefore argues that the astronomical evidence should be considered not simply as evidence of abstract celestial knowledge, but as part of a possible practical system for organizing seasonal time. At the same time, the study itself cautions that the inner feelings and intentions of the megalithic people cannot be directly recovered. The agricultural interpretation is consequently presented as a reasoned hypothesis grounded in the documented astronomical patterns, rather than as a proven reconstruction of prehistoric farming calendars.

Keywords: Megalithic Archaeology; Archaeoastronomy; Calendrical Knowledge; Agriculture; Sun Azimuth; Equinox; Solstice; Mudumala; Murardoddi; Menhirs; South India

1. Introduction

Agriculture depends upon time. The recognition of seasonal change, the onset of rains, suitable periods for cultivation and the timing of harvesting all require some system of observing environmental cycles. In prehistoric and early historic societies such knowledge did not necessarily take the form of a written calendar. It could be embedded in repeated observations of the Sun, Moon, stars, landscape and seasonal phenomena. the field study provides an important basis for examining this possibility in the context of South Indian megalithic monuments.

The study is explicitly concerned with archaeoastronomy, the study of possible relationships between archaeological monuments and celestial bodies. It describes the observation of the Sun, Moon, planets, constellations and Pole Star and attempts to understand how naked-eye observations may have been incorporated into megalithic construction. Its evidence is drawn from field drawings, exploration, excavation data, photography, compass and GPS measurements, Sun charts, Star Dial observations and digitalized archaeological drawings.

The present paper narrows that broad subject to one question: could some megalithic arrangements have helped communities recognize and organize calendrical or seasonal time relevant to agricultural and ritual activities? The question is important because the study itself connects solar movement with seasonal variation and later states that calendrical knowledge may have been important for sowing, cultivation and harvesting.

The paper does not assume that every megalithic monument was a calendar. Instead, it examines the evidence for intentional orientation and asks whether the repeated visibility of solar positions could have provided a practical framework for marking important points in the annual cycle.



2. Fieldwork Basis of the Study

The fieldwork described in the field study was organized around two broad activities: documenting archaeological monuments and observing celestial bodies. The study began with exploration of the physical setting, water sources and surrounding landscape, followed by determination of cardinal directions through GPS or compass, counting of monuments, recording monument features, observation of the sky with a Star Dial and examination of the surrounding area through Google Earth.

The fieldwork covered Mudumala, Murardoddi, Gudalellore, Maktal, Wargal and surrounding areas, Nagarjunakonda and Vaddamanu. The study explains that some sites were in poor condition or had been disturbed, while other data came from earlier archaeological surveys and excavations. Mudumala received sustained attention from 2004 and is described as a large site of about 250 acres containing stone circles, alignments and avenues. Its central area was drawn at 1:100 scale and contained 27 standing stones and 35 fallen stones, totaling 62 stones.

The fieldwork method is important for a calendrical interpretation because the proposed calendar is not inferred merely from the existence of large stones. The argument depends on direction, geometry, shadows and the relationship of monument axes to solar positions. At Wargal, the researchers used triangulation to document individual stones, established north–south and east–west reference lines, took repeated measurements and converted the field drawings into digital drawings. GPS was also used to record site latitude, longitude and elevation.

This combination of field measurement and astronomical observation makes the field study especially useful for reconstructing the proposed relationship between megalithic architecture and seasonal time.

3. The Sun as a Seasonal Clock

The central astronomical element in the field study is the Sun. Solar position changes through the year, and these changes can be observed without instruments. The study discusses the annual movement of the Sun between its northern and southern limits and relates this movement to the changing seasons. It uses the concept of solar azimuth—the direction of the Sun along the horizon—to examine monument orientations.

At Mudumala, the study describes east–west arrangements of standing stones and observations of their shadows around the equinoxes. The observations reported for 24 September and 21 March are treated as evidence that the relationship among the stones changed in a predictable way with the annual solar cycle. The study also discusses the seasonal movement of the Sun between the solstitial extremes. In this interpretation, a stone alignment could provide a fixed material reference against which the changing position of the Sun could be recognized.

This is the basic logic of a calendrical device: the monument remains fixed while the celestial event moves through a predictable cycle. A community does not need a mechanical clock to recognize annual time if a particular sunrise, sunset or shadow relationship recurs at approximately the same seasonal point. The archaeological problem is to establish whether the observed geometry was intentionally constructed for that purpose.

the field study does not claim that every alignment was a calendar. Rather, it examines particular alignments and asks whether their orientations correspond to solar events. That distinction is important when interpreting the evidence.

4. Mudumala and the Equinox

The equinox observations at Mudumala are among the clearest examples in the field study of a proposed calendrical relationship. Two standing stones are described as facing an east–west direction, with their shadows connecting at particular times around the equinox. The study records observations on 24 September and 21 March and explains that the same general solar-shadow relationship occurs twice in the year.



The significance of the observation is not simply that the stones point east and west. East and west are easily recognized directions. The more interesting feature is the relationship between the fixed stones, their shadows and the changing solar position. A recurring shadow configuration can provide a marker within the annual cycle.

The study also discusses the movement of the Sun's azimuth and associates this with seasonal changes. In its interpretation, the builders could have followed the changing solar direction without scientific instruments, using naked-eye observation and the geometry of the monument. If such observations were repeated over generations, the monument could become a community reference point for recognizing a particular time of year.

For agriculture, this possibility is significant but should be expressed carefully. The study does not provide a direct record saying that a particular Mudumala stone was used to announce sowing or harvesting. Instead, it proposes that the astronomical knowledge represented in the monument could have had calendrical value, while the wider conclusion connects such calendar knowledge with agricultural activities.

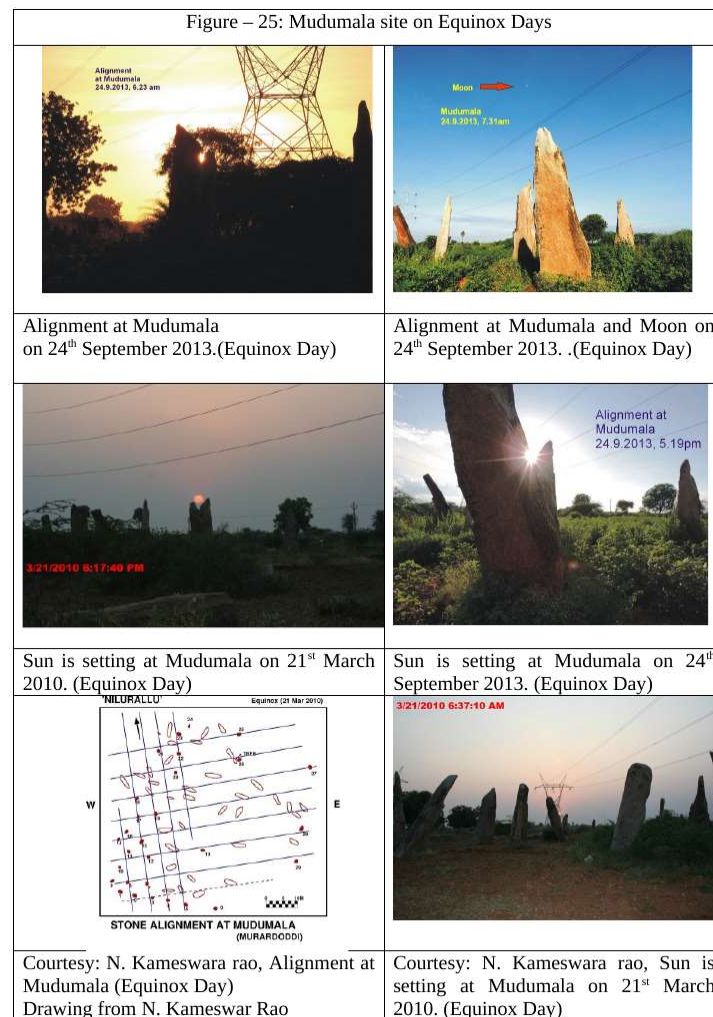


Figure 1. Mudumala site on Equinox Days (source Figure 25).



5. Menhirs as Possible Calendar Markers

the field study gives special attention to the menhirs at Mudumala. The field drawings show that the menhirs were systematically arranged and that some could be connected through north–south and east–west lines. Figure 28 in the source presents central menhirs together with diagrams of their north–south and east–west relationships.

The study explicitly asks whether the menhirs may have been arranged “as a sort of calendar” for arriving at different days of the year, harvesting, festivals and other functions. This is one of the most direct statements in the source connecting monument geometry with calendrical and agricultural practice.

The proposed mechanism is understandable. The Sun does not rise or set at exactly the same azimuth every day. Its horizon position shifts through the year, reaching seasonal extremes and then returning. A group of fixed stones could therefore provide sight-lines against which these changes were observed. Different alignments might correspond to different stages of the annual cycle.

The agricultural importance would lie not in the monument producing a modern numerical date, but in helping a community identify a recurring seasonal phase. Such a phase could be linked with the beginning of cultivation, monsoon preparation, harvesting or ritual festivals. The study itself uses this broader formulation, rather than claiming that a particular stone gave a precise modern calendar date.

This interpretation also helps explain why multiple menhirs could have been necessary. A single stone provides a reference point, whereas several stones can create a sequence of sight-lines and shadow relationships. A group of menhirs could therefore encode a series of recurring seasonal observations.

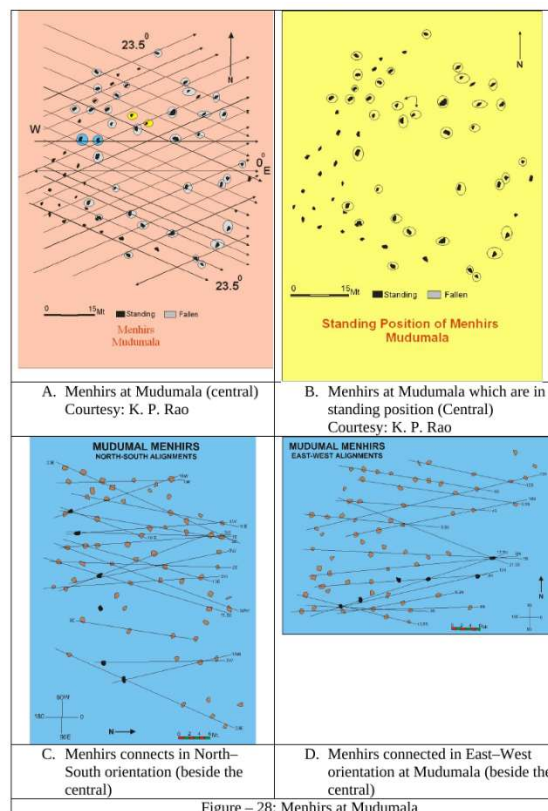


Figure 2. Menhirs at Mudumala: central arrangement and north–south/east–west orientations (source Figure 28).



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6. Solar Azimuth and Seasonal Variation

the field study uses Sun charts to compare solar azimuth across Andhra Pradesh. This is important because the Sun's apparent position varies not only through the year but also according to geographic latitude. The study compares districts such as Adilabad and Prakasam and observes differences in the timing of the Sun's overhead passage and in sunrise and sunset azimuths.

The study's Sun-chart discussion therefore adds a geographic dimension to calendrical knowledge. A solar observation that works at one latitude cannot necessarily be transferred unchanged to another location. The distribution of megalithic monuments across different parts of Andhra Pradesh means that local horizon and latitude must be considered when evaluating proposed alignments.

The study describes two Sun charts covering the annual cycle from June to December and from December to June. These charts are used to examine the changing solar azimuth and to compare northern and southern parts of the region. The source proposes that such differences could have been observable to megalithic communities and may have affected how monuments were positioned.

This is relevant to agriculture because seasonal indicators are local. The beginning of a farming season is not determined solely by an abstract astronomical date; it is experienced through local rainfall, temperature, vegetation, river conditions and the changing position of the Sun. A megalithic calendar, if one existed, would therefore have been part of a wider environmental knowledge system rather than an isolated astronomical device.

7. Solstices, Equinoxes and the Agricultural Year

The annual movement of the Sun provides several potentially useful reference points. The equinoxes occur near the points where the Sun crosses the celestial equator, while the solstices mark the annual extremes of solar declination. the field study treats equinox and solstice directions as significant for understanding megalithic alignments.

The agricultural value of such observations would be indirect but potentially substantial. A community observing a stable annual sequence could use celestial events as chronological markers even when the immediate agricultural trigger was rainfall or local environmental change. A solar event could indicate that a familiar stage of the season had arrived or was approaching.

The study's discussion of Mudumala connects seasonal solar movement with the organization of menhirs. It also states that the monument could have helped identify days and seasons and mentions harvesting and festivals. This suggests that calendrical knowledge may have had both economic and ritual dimensions.

A calendar should therefore not be understood simply as a table of dates. In a prehistoric context, it may have been a practical knowledge system based on repeated observations: the position of the sunrise, the length and direction of shadows, the appearance of the Moon, the seasonal movement of stars and the relationship between celestial events and environmental change.

8. Cup Marks and the Night Sky

Although the Sun is central to the calendrical interpretation, the field study also considers the Moon, stars, constellations and Pole Star. The cup-mark stone at Mudumala is particularly important. The study describes cup marks on the stone, their plotting and a possible comparison with the northern sky. It proposes that some of the marks might represent Ursa Major or other celestial features.

The cup-mark evidence is less secure than the solar-shadow observations. The marks can be documented, counted and mapped, but identifying them with a specific constellation is an interpretation. The study itself uses tentative language. For this reason, the cup marks should not be treated as a proven star calendar.



They are nevertheless important because a calendrical system may have included both day and night observations. The Sun could mark seasonal change during the day, while stars could provide orientation at night. If particular star patterns were recognized as recurring seasonal indicators, they could supplement solar observations.

The religious and agricultural dimensions could also overlap. Seasonal festivals might be organized around celestial observations, while agricultural tasks might be timed through a combination of solar, lunar and environmental indicators. The evidence from the field study is not sufficient to reconstruct such a complete system, but it justifies further investigation.

Map – 16: Gudabellore hills near to the Mudumala site and cup mark stone and hills are in the same longitude

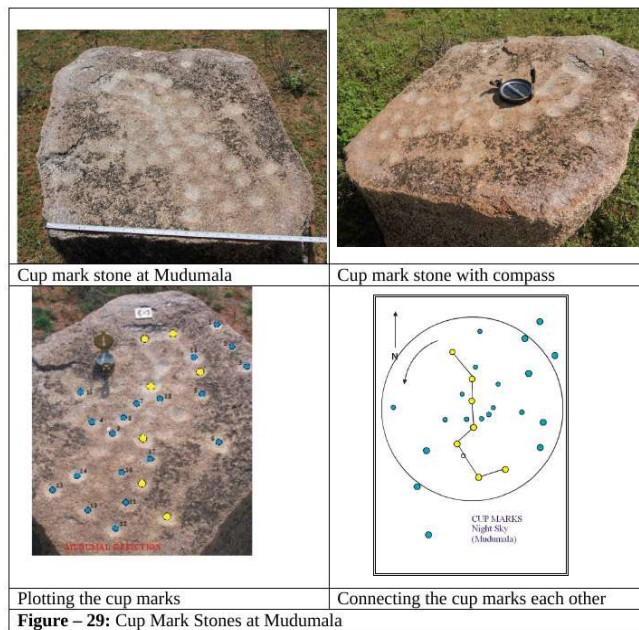


Figure – 29: Cup Mark Stones at Mudumala

Figure 3. Cup Mark Stones at Mudumala, including plotting and proposed celestial comparison (source Figure 29).

9. Murardoddi and the Calendrical Interpretation

Murardoddi, known in the local context as Nilurallu or “standing stones,” provides an important comparison within the same research tradition. the field study discusses the relationship between Mudumala and Murardoddi and records interpretations connecting the alignments with the Sun’s seasonal directions.

The Murardoddi evidence is particularly relevant because the standing stones are large and arranged in recognizable rows. The source discusses solar directions at equinoxes and solstices and the use of shadows. This strengthens the argument that some South Indian megalithic alignments can be studied as possible instruments for observing calendrical events.

The agricultural interpretation remains a hypothesis. A monument that marks equinox or solstice directions does not automatically demonstrate that farmers used it for sowing or harvesting. The relationship must be established through broader archaeological evidence. Nevertheless, the logic is plausible: a community that can identify recurring seasonal solar events possesses one component of a calendrical system, and such knowledge could be relevant to agricultural scheduling.

The importance of Murardoddi for the present paper is therefore comparative. It shows that the Mudumala observations are not an isolated conceptual possibility within South Indian archaeoastronomy. Similar questions about solar alignment and calendrical observation have been raised for other megalithic alignments.



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10. Agricultural Knowledge and Environmental Observation

The phrase “agricultural calendar” should not be understood as implying that astronomy alone controlled farming. Agriculture depends on rainfall, soil moisture, water availability, temperature, crop cycles, livestock and local ecological conditions. The field study itself notes the importance of physical setting and water sources during fieldwork. The megalithic landscape was therefore part of an environmental system.

The significance of celestial observation may have been to provide predictable chronological markers within that system. Solar position changes regularly and can be observed even when other environmental signs are uncertain. A community could compare a celestial event with local rainfall, river conditions, vegetation and crop development and gradually develop a practical seasonal knowledge system.

the field study explicitly links calendrical knowledge with agricultural activities in its broader interpretation. It refers to sowing seeds in monsoon times, cultivation of land and harvesting on particular days and suggests that the monuments may contain evidence of an awareness of seasonal divisions. This statement is important, but it remains an interpretation rather than direct evidence of a written or standardized agricultural calendar.

The strongest conclusion is therefore that astronomy may have contributed to seasonal time-reckoning, which could in turn have supported agricultural planning. The actual agricultural decisions would still have depended on local environmental observation.

11. Digital Documentation and the Study of Calendars

The technical advancement described in the field study provides an important foundation for testing calendrical interpretations. GPS allows the researcher to establish the geographic position and elevation of a site. Compass-based triangulation provides a method for establishing cardinal directions and plotting individual stones. Digital drawings preserve the measured geometry. Sun charts provide a model of solar azimuth, while the Star Dial assists with night-sky observation.

At Wargal, the field team established north–south and east–west reference lines, used known points at four-metre intervals and took six to ten measurements for each stone. The resulting drawings were produced at 1:50 and 1:100 scale and later digitized. This approach demonstrates how field archaeology can be transformed into a reproducible spatial dataset.

For calendrical research, the next step is to compare each monument axis with the actual solar horizon. This requires recording the azimuth of the monument, the altitude of the local horizon and the geographic coordinates of the site. The predicted sunrise and sunset positions can then be calculated for equinoxes, solstices and other candidate dates.

Such analysis would also help distinguish intentional astronomical alignment from coincidence. If several independent alignments cluster around the same solar events, the calendrical interpretation becomes stronger. If orientations are widely distributed without a significant pattern, other explanations should be considered.

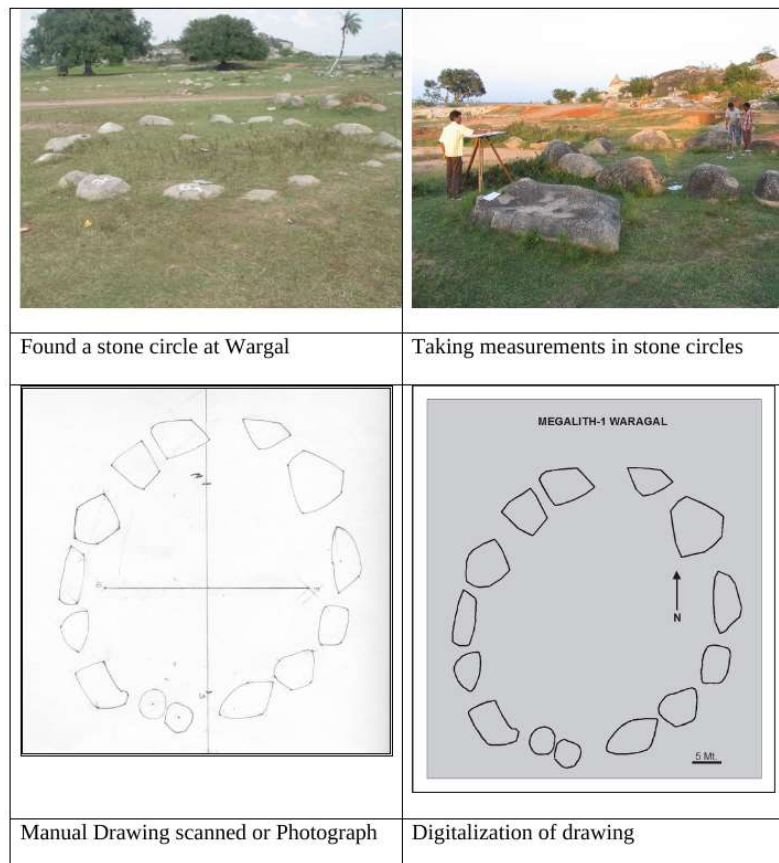


Figure 4. Field Drawing at Wargal: measurement, manual drawing and digitalization (source Figure 41).

12. GPS, Star Dial and Reproducible Archaeoastronomy

Figure 42 in the field study records the technological tools used in the field study: a GPS track at Wargal, a GPS instrument, a method for marking the northern or Pole Star direction and a Star Dial for night-sky observation. These tools demonstrate the movement from traditional field observation toward digital archaeoastronomy.

GPS is especially important because astronomical azimuth depends on geographic position. Latitude influences the relationship between the celestial sphere and the local horizon, while elevation and surrounding terrain influence visibility. A precise spatial record is therefore essential when comparing monuments.

The Star Dial provides another dimension. While the present paper concentrates on the solar calendar, the study's inclusion of night-sky observation indicates that megalithic calendrical knowledge may have involved more than the Sun. A complete reconstruction would have to examine the relationship among solar, lunar and stellar observations.

The fieldwork methods also make it possible to return to the same site and repeat measurements. This is essential for archaeological science. Interpretations should not depend solely on the memory of an individual observer or on a single photograph. A digital coordinate record allows future researchers to test the same hypothesis with new astronomical calculations and improved instruments.

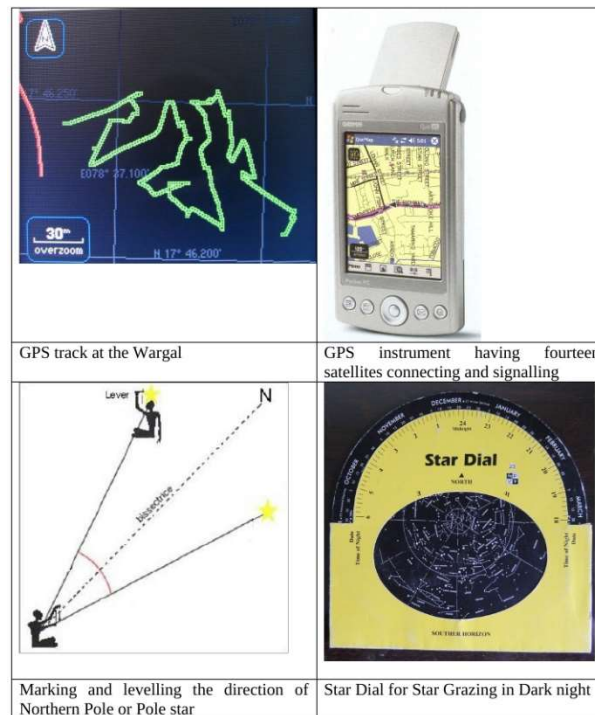


Figure 5. Field Instruments: GPS, northern/Pole Star direction marking and Star Dial (source Figure 42).

13. Calendars, Festivals and Social Organization

the field study does not restrict calendrical interpretation to agriculture. It also mentions festivals and other social functions. This is significant because agricultural and ritual calendars are often interconnected. Seasonal changes affect farming, while communities can transform seasonal transitions into collective ceremonies.

A monument that identifies a solstice or equinox could therefore have served more than one purpose. It could help recognize a seasonal transition, provide a reference for agricultural activities and become a location for communal gatherings. The source's discussion of Timmappa and Yallamma at Mudumala demonstrates that the landscape later acquired explicitly religious associations.

However, the present religious identity of the stones should not be projected directly into the prehistoric period. What can be said is that megalithic monuments remained capable of supporting later ritual meanings. This continuity of place is important for understanding how landscapes become culturally significant.

The calendrical interpretation therefore has three possible levels: practical seasonal observation, social coordination and ritual meaning. the field study provides evidence relevant to all three, but the strength of evidence differs. Solar alignments are measurable; agricultural use is plausible but indirect; prehistoric ritual meaning remains more difficult to reconstruct.

14. Limitations of the Calendrical Interpretation

Several limitations must be recognized. First, the archaeological record is incomplete. the field study notes that monuments have been damaged, removed, submerged, reused or disturbed. Second, not all sites preserve enough stones to reconstruct their original geometry. Third, a direction that appears astronomical may have resulted from practical considerations such as terrain, construction or local landscape.



Fourth, astronomical interpretation cannot by itself establish agricultural practice. To demonstrate that a monument was actually used by farmers for scheduling cultivation, researchers would need associated archaeobotanical evidence, settlement data, seasonal activity patterns or other independent evidence. the field study provides the astronomical and archaeological framework but does not provide a complete archaeobotanical dataset.

Fifth, the identification of cup marks with particular constellations remains hypothetical. The same caution applies to assigning a precise calendar function to every alignment.

These limitations do not make the research unimportant. They define the next stage of investigation. The value of the field study is that it identifies measurable relationships that can be tested with improved survey, digital modelling and archaeological comparison.

15. Conclusion

the field study provides substantial evidence for considering calendrical knowledge as one possible function of selected South Indian megalithic arrangements. The strongest evidence comes from the relationship between fixed stones and changing solar positions at Mudumala, the systematic arrangement of menhirs, equinox observations, solar azimuth analysis and the comparison of different regional latitudes.

The study explicitly raises the possibility that the menhirs functioned as a kind of calendar for recognizing different days of the year, harvesting, festivals and other activities. This provides a direct foundation for the present argument. The agricultural interpretation should nevertheless remain cautious: the monuments demonstrate possible astronomical observation more clearly than they demonstrate specific farming decisions.

A useful reconstruction is therefore that some megalithic communities may have possessed a practical seasonal knowledge system based on repeated naked-eye observation of the Sun and perhaps the Moon and stars. Monumental stones could provide fixed reference points against which these celestial changes were recognized. Such knowledge could have helped structure seasonal time, while agricultural and ritual activities gave that time social importance.

Mudumala is particularly important because the study combines monument geometry, field observations, solar analysis, menhir arrangements and cup-mark evidence in a single landscape. Murardoddi provides a comparative alignment tradition, while Wargal demonstrates the detailed field measurement necessary for future testing.

The next phase of research should integrate archaeological dating, GPS/GIS survey, precise horizon measurements, astronomical software, archaeobotanical evidence and statistical analysis. Only through this combination can the hypothesis of a megalithic agricultural calendar be evaluated rigorously. the field study therefore offers not a final answer, but a strong field-based starting point for understanding how celestial observation may have been connected with seasonal life in South India.

Notes

1. P. Phanesh Babu, supplied field research material: fieldwork methods, sites, Mudumala fieldwork and central stone arrangement.
2. P. Phanesh Babu, supplied field research material: Mudumala alignments, solar directions, north–south and east–west orientations and related field drawings.
3. P. Phanesh Babu, supplied field research material: equinox observations, solar azimuth, seasonal movement and related observations.
4. P. Phanesh Babu, supplied field research material: menhir arrangements, north–south and east–west connections and related drawings.
5. P. Phanesh Babu, supplied field research material: cup marks, northern orientation, Gudabellore hills and related documentation.



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