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FINDING KING JANAMÉJAYA'S ECLIPSE

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Abstract: There are innumerable records on stone and metal found in India detailing grants of land and donations made by kings and chieftains to Brahman priests, many on the occasions of eclipses and on the cardinal days. In this paper we investigate one such grant, first written about by Henry Colebrooke in 1809. It is from Gauj, the modern Gowthamapura in Shivamogga district in Karnataka state. Spread over three copper plates, the inscription is in mixed Sanskrit and Kannada and records a charitable grant of several villages made to thirty-two thousand Brahmans on the occasion of a sarpa yagna (snake-sacrifice) and a solar eclipse by Janaméjaya, the Puranic monarch who reigned over Hastinapur at the commencement of Kaliyuga. The eclipse was in the lunar month of Chaitra, on a Sunday, in Asvini naksatra. The grant further specified the circumstances such as Vyatipata (*pata* – aspect), and that on the following day the *naksatra* was Bharani and the *karana* (the half-*tithi*) was Kimstughna. These specifications make it the rarest of the rare eclipses.

However, there is no eclipse mentioned in Janaméjaya legends, so was the eclipse in the grant genuine or an invented one? There were attempts made in the 1860s to identify the eclipse and possibly date the grant, but the identifications are not valid. In this paper we examine all such eclipses that occurred between 601 and 1699 CE and were visible from India. There are six such eclipses, in 712, 739, 851, 1027, 1372 and 1548 CE. Of these, we find the eclipse of 1027 CE as historically the most suitable one.

Keywords: Karnataka epigraphy, Gauj Agrahara grant, solar eclipses, King Janaméjaya, Henry Colebrooke, John Faithfull Fleet, Benjamin Lewis Rice, Ganesa Daivajna, Bapu Deva Sastri

1 INTRODUCTION

Eclipses have long been part of India's cultural and political history. These are special occasions when the Hindus throng to the nearest river, engage in ceremonial ablution and oblation and offer charity. In the ancient Indian literature and chronicles, one hardly finds references to fireballs, eclipses and the comets but there are innumerable records on stone and on metal detailing grants and donations by the Hindu kings and chieftains made on the occasions of eclipses and on the cardinal days of the year, or to commemorate the heroic acts, etc. The inscriptions also recorded the respective genealogies and religious activity. The earliest such records date to the middle of the first millennium.

In the southern parts of India, *Vyatipāta*, the yoga *Vaidhriti* and the eclipses were regarded as *puṇya kāla*—an occasion for good deeds, to make royal grants and donations. This practice was followed by the Kadambās (4–6 centuries), Rāshrakūtas (6–8 centuries), Chālukyas (6–8 and 10–12 centuries) and the Vijayanagara Empire (14–17 centuries). The records amply demonstrate the common belief that celestial events cast their influence on the lives of the rulers and the folk.

The records of eclipses, whether on copper plates or in stone inscriptions, are very important as they serve as the basis for verification of the dates in history or narrow down the timelines arrived at by other methods. The records of ancient eclipses are valuable as these shed light on the long-period dynamics of the Earth-Moon system.

This paper investigates an inscription on metal, known as the Gauj Agrahāra grant. It was first written about in 1809 by Henry Colebrooke (1809). The grant, which is written on three copper plates, is extraordinary in that it is attributed to Janaméjaya, the Purāṇic monarch who reigned over Hastināpur at the commencement of the Kaliyuga, and purports to alienate land on the occasion of a snake-sacrifice and solar eclipse. It was a *Chaitra-Asvini-Sunday* eclipse, governed by *Vyatipāta* (*pāta*—aspect), and, the *naksatra Bharaṇi* and the *Kimstughna karaṇa* (the half-*tithi*) on the following day. It was therefore not just your 'everyday' eclipse. The circumstances make it rarest of the rare.

Serious doubts are often raised about the authenticity of grants recorded on copper-plates. They may carry palaeographic, orthographic and historical anomalies, and the inscription may be anachronistic in language and style (Salomon 1998: 167). The metal also suffers oxidation, and eventual corrosion and cracking. Atmospheric corrosion results from exposure to moist air, causing the metal to change colour in a few years from a shiny brown to a darker brown and then blue. In a matter of 10–20 years, there forms a blue-green coating, termed *patina*, that serves as a protective layer to preserve the metal underneath. However, unfavourable storage, improper upkeep and circumstances in life can take their toll.

Apart from the Gauj Agrahāra grant there

are a few other grants, also on metal plates, that have been attributed to King Janaméjaya. But the Gauj Agrahāra grant is the only one dated-lined with an eclipse. Purānic references are not possible to date. However, the Janaméjaya grants are about real lands and the assignees. Since the inscriptions refer to weekdays and astronomical terminology that was first used from the middle of the first millennium, the plates cannot be several thousand years old, and must belong to historical times. The grants were possibly written when there were uncertain times in the country, and the authors made claims by invoking remote and vague patronage that would be beyond question.

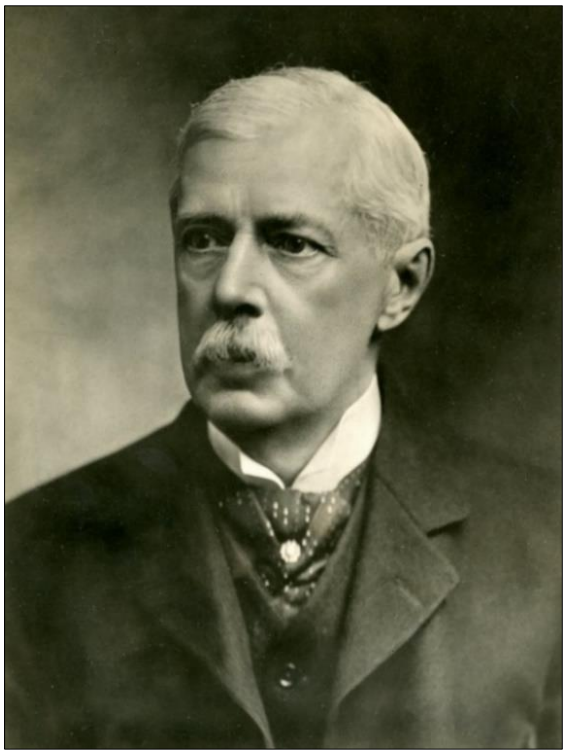


Figure 1: John Faithfull Fleet in 1912 (courtesy: Royal Asiatic Society of Great Britain and Ireland).

It is obvious that the grants are concoctions. It is the detail that draws attention. There were attempts made in the 1860s to identify the eclipse and thereby possibly date the Gauj Agrahāra grant. Captain George Peacock made astronomical calculations and suggested the solar eclipse to be of 3 April 889 AD. However, it turned out to be a Friday eclipse. Subsequently, the Reverend G.B. Gibbons and the Astronomer Royal, George Biddell Airy suggested another eclipse, that of 7 April 1521. This eclipse appeared to be a strong contender. Only, it was out of step with the history of the region. We also find this eclipse a misfit, as it does not meet all of the criteria in the grant. This raises doubts about whether the eclipse was genuine or was invented.

Widening the search to the period 601–1699 CE, we identify fourteen *Chaitra-Asvini*-Sunday eclipses, including that of 1521 CE. The eclipses that also fulfil the criteria of the next day's *nakshatra* and *karana* are six. We discuss these eclipses to see if there is one that fulfills all of the criteria.

It is imperative that we first briefly place the earlier research on this grant in perspective. In what follows, for historical reasons we have chosen to retain the old names/spellings.

2 DECODING HISTORY ON STONE AND METAL

Over the last few centuries, and particularly since the turn of the nineteenth century, a wealth of information contained in the inscriptions on copper plates, stone slabs, walls and pillars in temple complexes has been brought to light by European and Indian scholars and orientalists, eager to map the history of India. John Faithfull Fleet (1847–1917; Figure 1) was a British civil servant and an historian with great interest in Indian epigraphy who learnt Sanskrit and later Kannaḍa. He made important studies of the inscriptions on stone and on copper-plates in Southern India during the three decades of his service in India, and even after his return to England. Fleet observed that sometimes a grant was made on an eclipse day when it was not even visible in India. He argued that on just that count, these inscriptions should not be dismissed as spurious (Fleet 1890: 323–324). It was not imperative that when an eclipse had been predicted, the grant would be made only if the donor was actually able to witness the eclipse. Fleet (1890: 324) cited Hermann Jacobi who believed that eclipses referred to in inscriptions were to be interpreted as calculated, and not as actually observed.

In the matter of the inscriptions, a crucial aspect is the use of eras in the chronology of events. The eras initially were regnal, referring to the day of coronation of a king. The Śaka era (also the Sālivahana Era) starts from 15 March 78 CE. This date marks the reign of the Kushāṇa king Kanishka (r. 78–102 CE) and has been used by the traditional astronomers since the time of Varāhamihira (Saha and Lahiri, 1955: 255–256). Śaka dates are more common in the inscriptions from South India and very often the years have elapsed.

The Vikrama Era, named after King Vikramāditya of Ujjain, is widely used in the north-western states of India. The zero year of the Vikrama Era is 58 BCE (–57) but its origin is not clear. The use of the Era is seen in inscriptions from the ninth century only. The Vikrama calendar is luni-solar. The year begins from the New

Moon of *Chaitra* (*Chaitra Śukla Pratipada*; late March to early April), starting a series of celebrations. However, throughout India, the beginning of the year is not uniform (see Shastri, 1996: 54).

The first reference to the *Brhaspati Samvatsara Chakra*, i.e., the Sixty-Year Jovian cycle, is found in the *Sūrya Siddhānta* (Burgess, 1860(I): 55). In this cycle, the year is not exactly a solar year, and is the period over which the planet enters a zodiac and passes into the next with reference to its mean motion (Sewell and Dikshit, 1995: 32–33).

3 THE GAUJ AGRAHĀRA GRANT: FIRST IMPRESSIONS

Henry Thomas Colebrooke (1765–1837; Figure 2) was an acclaimed Sanskrit scholar, mathematician and orientalist and the founder of The Royal Asiatic Society of Great Britain and Ireland in 1823 that, as per the Royal Charter from King George IV in 1824, aimed "… for the investigation of subjects connected with and for the encouragement of science, literature and the arts in relation to Asia." (The Royal Asiatic Society, 2022).

In one of his earliest communications to the *Asiatic Researches*, Colebrooke presented and discussed nine ancient inscriptions in Sanskrit on metal. One of the inscriptions, spread over three copper plates, purported to be a grant made on the occasion of a solar eclipse by King Janaméjaya who reigned at the commencement of the present age or *Caliyuga* (Colebrooke 1809: 446). The language in the inscription is mixed Sanskrit and Canarese (Kannaḍa). It was Major Mackenzie who communicated a copy in facsimile of the said inscription to Colebrooke (1809: 446–447) who then wrote:

> It is in the hands of the *Brāhmens* or priests of *Goujda Agraharam* in *Bédnūr*; and was, with some reluctance, entrusted by them to MAJOR MACKENZIE, who himself took from it a copy in fac simile, the exactness of which is demonstrated by the facility with which the inscription may be decyphered from that copy. The original is described as contained in three plates of copper, fastened together by a ring, on which is the representation of a seal, bearing the figure of a boar with a sun and crescent. The purport of the inscription, for I think it needless to make a complete version of it, is that JANAMÉJAYA, SON of PARICSHIT, a monarch reigning at *Hastināpura*, made a progress to the south, and to other quarters, for the purpose of reducing all countries under his domination; and performed a sacrifice for the destruction of serpents, in presence of the god (or idol) HARIHARA, at the confluence of the rivers *Tungabhadrā* and *Haridā*, at the time of a partial eclipse of the sun, which fell on a Sunday in the month of *Chaitra*, when the sun was entering the northern hemisphere; the moon being in the *Nacshatra Aśvini*.
>
> Having completed the sacrifice, the king bestowed gold and lands on certain *Brāhmans* of *Gautamagrāma*: whose names and designations are stated at full length, with the description and limits of the lands granted.

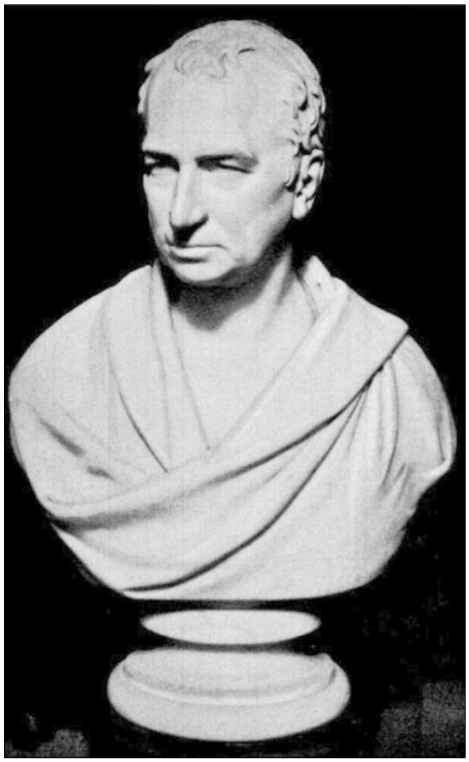


Figure 2: Photograph of a bust of Henry Thomas Colebrooke created by Henry Weekes in 1837 (after Pargiter, 1923. Frontispiece).

The 'Major' referred to by Colebrooke was Colonel Colin Mackenzie (1754–1821; Figure 3; Kumar, 2022: 25–29), an Officer of the Madras Engineers in the East India Company who later, in 1815, became the first Surveyor General of India (Phillimore 1945(I): 349). Mackenzie was himself an Orientalist, and had built up an exceptional collection of Indian antiquities, including manuscripts, inscriptions, coins, paintings, illustrations, etc.

In Major Mackenzie's opinion the monumental plates appeared to be authentic, and

could not be recent forgeries because "… the people themselves cannot read the inscription." (Colebrooke 1809: 448).

The name of Royalty in the Gauj Agrahāra grant, King Janaméjaya, arouses curiosity because it was *Purāṇic*, so that the grant would presumably belong to the time when the *Purāṇic Kaliyuga* had just commenced (Section 5). Colebrooke (1809: 447–448) cited the part of the Sanskrit text that mentioned the astronomical circumstances of the solar eclipse:

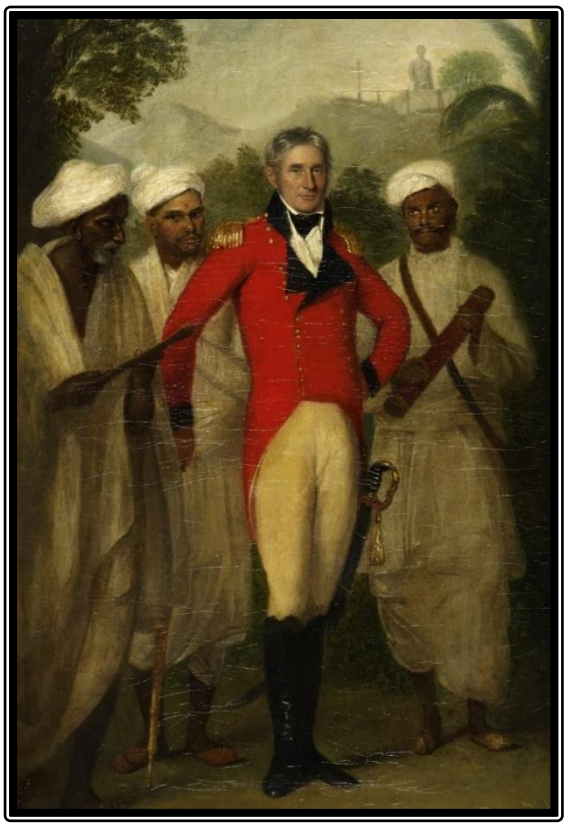


Figure 3: An 1816 oil painting of Colonel Colin Mackenzie by Thomas Hickley now in the British Library (https://artuk.org/discover/artworks/colonel-colin-mackenzie-17541821-191015#).

> *Chaitramāsé crishna* [should be *çrishna*] *pacshé*
> *sū …… carana uitārayana san …… vyatipāta nimitté*
> *sūrya parvani ardha grāsa grihta* [should be *grihīta*] *samaé,* [should be *samayé*].

The text speaks of an eclipse of the Sun in *Uttarāyaṇa* (i.e., the Sun on its northern journey) in the month of *Chaitra*, New Moon of the dark fortnight, on Sunday, half-eclipse governed by *Vyatipāta*. After completing the *Sarpa Satra yagna* (snake sacrifice), King Janaméjaya gifted to certain Brāhmans gold and twelve villages constituting the village of Gautamagrāma (Fleet, 1901: 220). The Gauj inscription also specifies in detail the extent of the lands, and the names and designations of the recipients.

But Colebrooke (1809: 448-449) had major reservations:

> Numerous and gross errors of grammar and orthography, which can neither be explained by a gradual change of language, nor be referred to the mistakes of a transcriber or engraver, but are the evident fruit of ignorance in the person who first penned the inscription in Nāgarī characters, would furnish reason for discrediting this monument, were it otherwise liable to no suspicion. But, when to this circumstance are added the improbability of the copper plates having been preserved during several thousand years, and the distrust with which any ancient monument must be received, where its present possessor, or his ancestor, may have had claims under the grant recorded in it, there can be little hesitation in considering this grant of Janaméjya as unauthentick: independently of any argument deduced from the character, which is not perhaps sufficiently antique; or from the astronomical data in this inscription, which, however consistent with Indian notions of astronomy and chronology, will hardly bear the test of a critical examination.

An *Agrahāra*(*m*) is an exclusive locality of closely-knit Brahman families built on land granted by the king or some noble for religious purposes, with entitlement to royal income deriving from such land. Gauja, now known as Gowthamapura (14.146° N, 75.221° E), lies in the Sāgara Taluka of Shivamogga district in Karnataka. It is connected with the sage Gautama who had his hermitage here (Census of India 1981, 1986: 28). It is situated about 7 km north of Anandapura (older name Anantapuram) and about 20 kilometres south-west of Shikāripur. In its annual report for 1940–41, the Mysore Archaeology Department (1942: 75) described it as an ancient Agrahāra town, now an insignificant place but with many temples, e.g., the Durga, Veerabhadra and Banashankari temples, and near a pond the Gautameśvara Temple and a Sūryanārāyaṇa Temple, both from the Rāshtrakuta period (6–8 centuries); see Mysore Archaeology Department (1942) for more on the temples in Gowthamapura.

4 THE JANAMÉJAYA GRANTS

There are several epigraphical records that are considered to be of doubtful authenticity or value. Some records claim religious grants while others are spurious title-deeds. An extensive search led J.F. Fleet (1901) to list quite a number of spurious records. He found four records from Shimogā (Shivamogga; 13.92° N, 75.57° E) district that attributed the grants to

King Janaméjaya (Fleet 1901: 219–220). Rice (1902: 2) noted that the introductory titles assigned to the King are Chālukyan only.

The first one is the Bhimanakatte or Tirthhalli Plates, granting land to the local ascetics (Brahmaṇs) for the purpose of worshipping the god Sitārāma. The date is *Plavaṁga saṁvatsara*, in the year 89 (current) of the Yudhishthira-Śaka (i.e., era of Yudhishthira), in the month of *Sahasya* (*Puśya*) on New Moon day, on Wednesday (Fleet, 1875: 327; Narasimmiyengar, 1872: 378). Following the traditional *panchāngas*, the date translates to 3014 BC. On this, Fleet (1901: 219) remarked:

> According to the popular view, as exhibited in the Native almanacs of the present day, the era of Yudhishthira is the first three thousand and forty-four years of the Kaliyuga, that is to say, the period from the beginning of the present age in B.C. 3102 to the commencement of the so-called Vikrama era in B.C. 58 … On the other hand, according to the astronomer Vriddha-Garga, as reported by Varāhamihira (died A.D. 587) in his *Bṛihatsamhitā*, *xiii*. 2, the duration of the era of Yudhishthira was two thousand five hundred and twenty-six years; and Kalhaṇa, quoting Varāhamihira's verse in his *Rājatarangiṇi*, *i*. 56, shews, by a previous verse, 52, that by him at least, in A.D. 1148-49, it was understood that the era began (and the commencement of the reign of Yudhishthira took place) two thousand five hundred and twenty-six years before the commencement of the Śaka era in A.D. 77; that is to say, that the era began in B.C. 2449 or 2448 … The mention of the Plavaṁga *saṁvatsara* in the date put forward in this record, shews that the date was put together according to the popular view, with B.C. 3102 as the commencement of the era.

Bhimanakatte is located on the banks of River Tunga and the folklore has it that Pāndavas had stayed here in the past. The year *Plavaṁga* is 41 in the 60-year Jovian cycle.

The Begūr Plates also attribute the grant to Janaméjaya Chakravaratti, claiming that at the beginning of the *sarpayāga* or snake-sacrifice Janaméjaya granted ten villages to one thousand three hundred Brahmans of Beguru in the northern Edenādu Seventy in the Banavāsi Twelve-Thousand Province (Fleet, 1901: 91).

The third one is the Kuppagadde or Soraba Plates. The grant claims that during an expedition of conquest, on the occasion of the snake-sacrifice, at the time of performing *pūrṇāhuti*, in the *Chaitra Krshṇapaksha* of the year 111, Monday combined with the *Naksatra Bharaṇi*, *Sankrānti* and *Vyatipāta*, King Janaméjaya granted ten villages, which constituted the village of Pushpagadde to two thousand Brahmans of Pushpagadde in the Edenādu Seventy in the Banavāsi Twelve-Thousand Province (Fleet, 1901: 220). Names are given in respect of the four chief Brāhmaṇs only. Pushpagadde is the present-day Kuppagadde (Narasimmiyengar, 1872: 375). Rice (1879: 94) believed that the inscription in the grant was not earlier than the twelfth century.

A comment on the 'year 111' is due. In the grants, there is an expression *katakamutkalita*. As per the *Katapayadi* system,[1] the syllables *ka-ta-ka* stand for the numerals 1-1-1 (Fleet, 1895: 141; Rice, 1879: 92), implying the year to be 111. However, the word can be subdivided as *katakama* and *utkalita* also, so that *ka-ta-kam* implies 1-1-1-5 and the expression can be taken for the Śaka year 1115 (elapsed). That is 1193–1194 CE and, according to Rice (1879: 98; see also Fleet 1901: 220), could be the probable date of the concoction of this and some other grants wherein the same phrase is employed though they saw no strong reason to divide the expression *katakamutkalita* this way. The expression may also mean "… having halted the army …" (Rice, 1879: 92), or "… a camp was pitched …" (Fleet, 1901: 220).

The fourth is the Gauj or Anantapur Plates, the subject of this paper. Fleet (1901: 220) identified the place of the grant with modern Gauj in (the then) Shikāripur Taluka of the Shimoga District. It says that at the end of performing the snake-sacrifice called *pūrṇāhuti-tadanga-samaya*, on the day of solar eclipse, Janaméjaya granted to thirty-two thousand Brahmans the twelve villages constituting Gautamagrāma in the Santālige Thousand in the Banavāsi Twelve-Thousand province. The names of only four beneficiaries are given, with some detail about them. Fleet (1901) believed that this grant was an imitation of the one made to a congregation of thirty-two thousand Brahmans who are mentioned in the records of the eleventh and twelfth centuries at Tālagunda (Tālgund) in the Shikāripur Taluka (see Rice, 1902: 200–202 / Eng. Part :113–115).

In Figure 4, we have a screenshot of the Gauj Plates *Ib* and *IIa* from Rice (1902). In Plate *Ib*, the name 'Janaméjaya Chakravarti Hastināpur' appears in line 10 and the eclipse in line 13, continuing on line 1 in Plate *Ib*. Gauj plates *IIb* and *IIIa* in (Rice, ibid.) are not needed for our purposes and so have not been reproduced here.

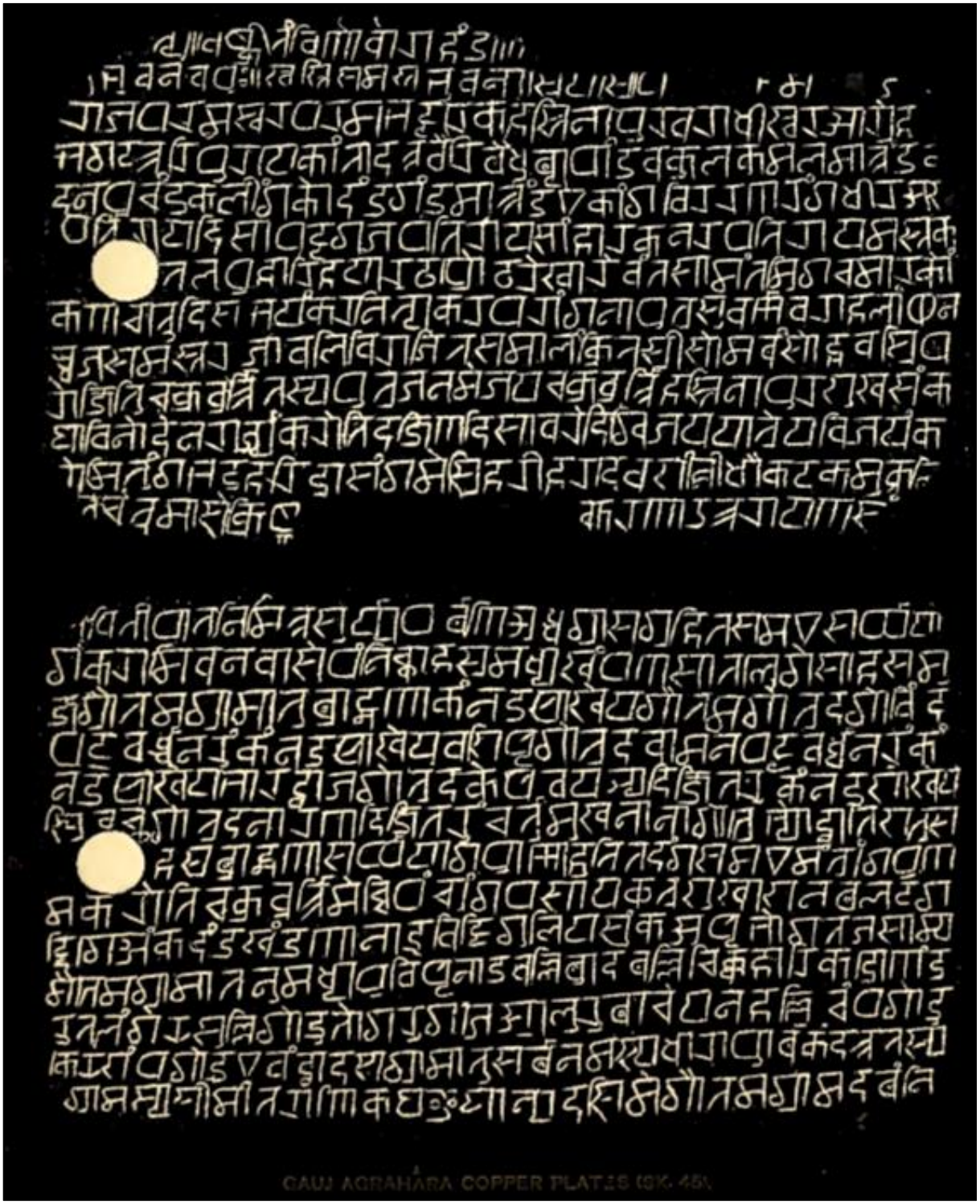


Figure 4: The Gauj Agrahāra Copper Plates *Ib* and *IIa* (Sk. 45) (after Rice, 1902: facing page 96).

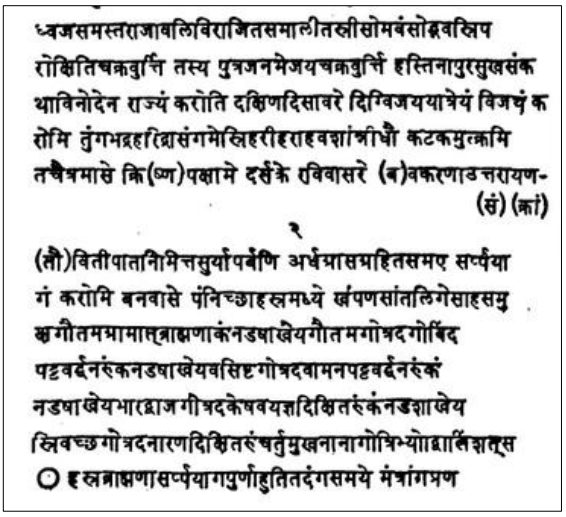
Narasimmiyengar (1872: 375–379) provided the transliteration and also the translation of the inscriptions of the Kuppagadde, Gauj and Bhimanakatte Matha grants. The part of the text in Plates *Ib* and *IIa* of the Gauj inscription which is of direct interest here is presented in Figure 5. A *Matha* is an abode of the Hindu ascetic order. The translation of the text in Figure 5 is as follows:

The son of the Emperor Parikshit; was reigning at Hastināpura, (diverted) by happy historic amusements. On a certain occasion, during an expedition of conquest in the south, at the shrine of Harihareśwara, at the confluence of the rivers Tungabhadra and Haridrā, in the dark fortnight of the month of Chaitra, in the year 111, on new-moonday,

which was a Monday, coupled with "Bharani Nakshatra, and Kimstugna karana," (astrological terms denoting particular constellations, &c.,) in Vuttarāyana (when the sun is in the tropic of Capricorn) and in Sankrānti, governed by Vyatipātam, on the occasion of a solar eclipse, when the sun was half obscured; when the snake sacrifice was performed, and when the principal rite of consummation was being conducted; the Emperor after duly saluting the Brahmans of various Gotras; coadjutors in the sacrifice, who had arrived to the number of 32,000 from Banavase, Śāntaligé Gautamagrāma and other villages; notably … (Narasimmiyengar, 1872: 377).

In his translation, Narasimmiyengar (1872: 377–378) mentioned Monday as the day of the eclipse. However, in the facsimiles he later provided (Narasimmiyengar, 1874: 268), it is Ravivāsare (Sunday) as the day of the eclipse (see lines 5 and 6 in Figure 5). Notably, the inscription does not say it is an eclipse in the zodiac Aries.

Figure 6 shows a part of coastal Karnataka,



ध्वजसमस्तराजावलिविराजितसमालीतस्रीसोमवंसोद्भवस्रिप
रोक्षितिचक्रवुर्त्ति तस्य पुत्रजनमेजयचक्रवुर्त्ति हस्तिनापुरसुखसंक
थाविनोदेन राज्यं करोति दक्षिणदिसावरे दिग्विजययात्रेयं विजयं क
रोमि तुंगभद्रहरिद्रासंगमेस्रिहरीहराहवशांत्रीधौ कटकमुत्क्रमि
तचैत्रमासे कि(ष्ण)पक्षामे दर्सके एविवासरे (ब)वकरणाउत्तरायण-
(सं) (क्रां)
२
(तौ)वितीपातनिमित्तसुर्यापर्वणि अर्धमासमहितसमए सर्प्पया
गं करोमि बनवासे पंनिच्छाहस्रमध्ये स्रंपणसांतलिगेसाहसमु
स्रगौतमग्रामात्रात्रात्रणाकंनडषाखेयगौतमगोत्रदगोविंद
पट्टवर्द्धनरुंकनडषाखेयवसिष्टगोत्रदवामनपट्टवर्द्धनरुंकं
नडषाखेयभारद्वाजगोत्रदकेषवयज्ञदिक्षितरुंकनडशाखेय
स्रिवच्छगोत्रदनारणदिक्षितरुंचतुर्मुखनानागोत्रिभ्योद्वात्रिंशत्स
ओ हस्रब्राह्मणासर्प्पयागपुर्णाहुतितदंगसमये मंत्रांगप्रण

Figure 5: The Gauja Agrahara Copper-Plates transliteration (after Narasimmiyengar, 1874: 268).

where the locations referred to in this paper are duly marked. Note that all of these places are located around Shivamogga, within a degree of latitude 14° N and longitude 75° E. With respect to the Ujjain meridian, which is at 75.777° E, this is more than a coincidence, remembering that the longitude of a place is a critical factor in astronomical predictions, particularly of eclipses.

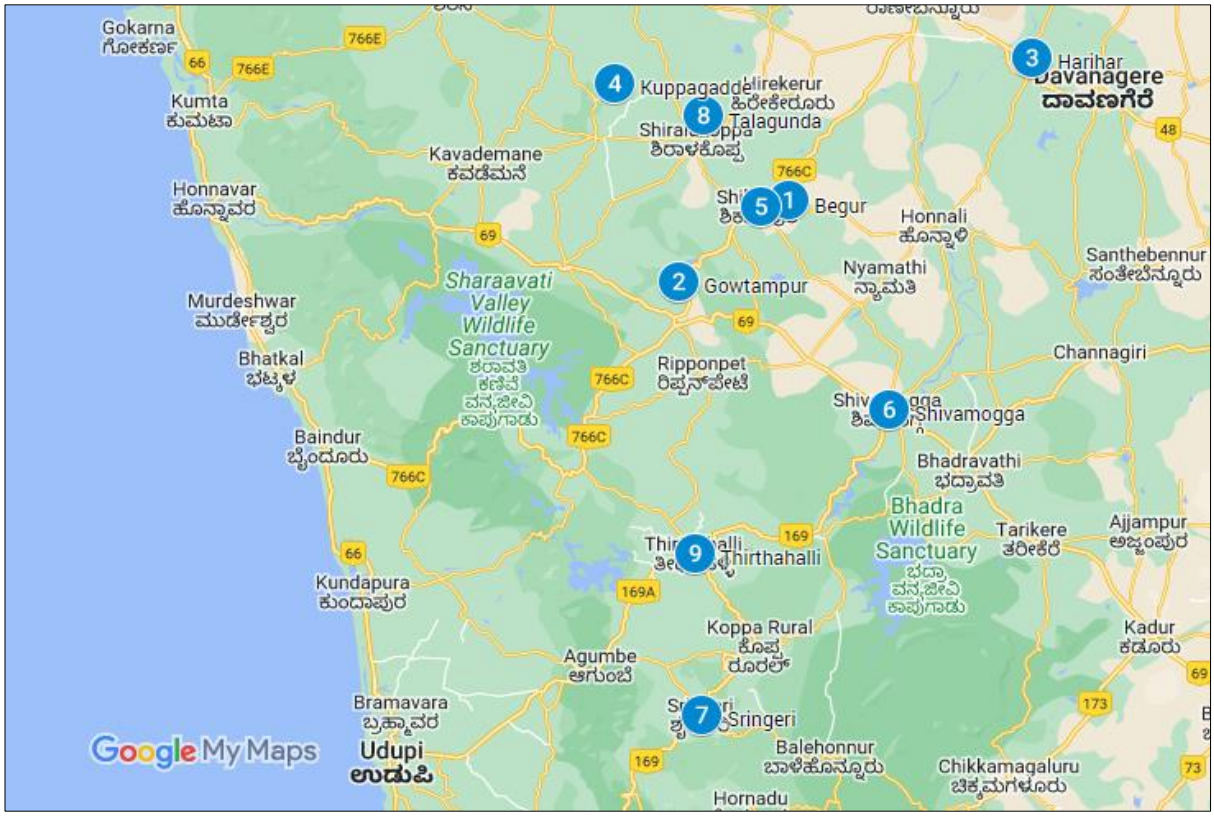


Figure 6: A map showing coastal Karnataka, with the Arabian Sea to the west of the coast. The numbers show the locations around Shimoga (now Shivamogga) mentioned in this paper: 1. Begur, 2. Gowthamapura, 3. Harihar, 4. Kuppagadde, 5. Shikaripur, 6. Shivamogga, 7. Sringeri, 8. Talagunda, 9. Tirthahalli. All of these places are located within one degree of ~14° N, ~75° E (Google My Maps; map modification: R.C. Kapoor).

Figure 7: King Parīcshit bitten by Takshaka. The illustration is from *Razmnāmā* (*The Book of War*), the Persian translation of the *Mahābhārata* commissioned by the Mughal Emperor Akbar ca. 1605 (Wikimedia Commons).

5 DATING KING JANAMÉJAYA

Janaméjaya was the son of King Parīcshit of Pāndava lineage (*Mahābhārata*, *Ādiparva*: Chapter 3) and ruled from Hastināpur. Parīcshit was the son of Abhimanyu and the grandson of Arjuna, the younger brother of Yudhishthira. Parīcshit was cursed by the sage Śrangi that he would die of snakebite. The sage sent the serpent king Takshaka to do the task. Figure 7 shows King Parīcshit being bitten by Takshaka.

The illustration is from the *Razmnāmā* (*The Book of War*), the Persian translation of the *Mahābhārata* commissioned by the Mughal Emperor Jalāl ud-Din Muḥammad Akbar (1542–1605; r. 1556–1605; Rice 2010: 125–131).

Takshaka's act prompted Janaméjaya to perform a massive yagna, the *Sarpa Satra* (snake-sacrifice), in order to destroy all the serpents. However, on the occasion, Brihaspati, the great sage and guru of the Devās (as per the *Mahābhārata*, it was a Brahmana by name Āstīka), urged King Janaméjaya to stop the massacre and also free Takshaka, who then consented. The episode is described in the *Ādiparva* (Chapters 50–53) of *Mahābhārata*.

As Janaméjaya ruled at the commencement of *Kaliyuga*, it is necessary to clarify the concept. As per the *Mahābhārata*, a Great War took place between the Kauravas and the Pāndavas at Kurukshetra that went on for eighteen days. This happened at the junction of the *Dvāpara* and the *Kali* eras.

The *Sūrya Siddhānta* (*SS*; ≥400 CE; Saha and Lahiri 1955: 238), a text book of Hindu Astronomy, says that

> The calculation of the mean place of the planets may be made from any epoch (*yuga*) that may be fixed upon. Now, at the end of the Golden Age (*Kṛtayuga*), all the planets, by their mean motion – excepting, however, their nodes and apsides (*mandocca*) – are in conjunction in the first of Aries. (Burgess, 1860(I): 56–57).

The planets return to the universal conjunction at the same point after a certain fixed interval of time. The epoch of last such conjunction was taken by the later astronomers as the beginning of the present *yuga*, the *Kaliyuga*. Counting the number of days (*ahargaṇa*; heap of days) elapsed since the last general conjunction of the mean planets up to the present, the instant of the current *Kaliyuga* was calculated. In modern timekeeping, it was midnight of 17/18 February 3102 BCE (i.e., –3101), as on the meridian of Ujjayini (Saha and Lahiri, 1955: 252–254). The Kali-counting is purely an astronomical facility which is neither religious nor regionally specific. It was first introduced by Āryabhatta (476–550 CE) in his work the *Āryabhatīya* (499 CE), and is still used in traditional *panchāngas*.

The derivation of the universal conjunction was a back-calculation and based on inaccurate astronomical parameters. A modern computation makes it amply clear that on the specified night, the planets did not congregate in the Aries sector of the zodiacal circle as stipulated. The concepts of *Purāṇic Kaliyuga* and the astronomical *Kaliyuga* thus stand on entirely different grounds. Although Saha and Lahiri (1955: 253) called the *astronomical Kaliyuga* an 'astronomical fiction', it has been used to date the *Mahābhārata* War. Since *Kaliyuga* supposedly commenced 36 years after the War, some have dated the War and the start of the Yudhisthira Era to the year 3138 BCE. In contrast, Varāhamihira (Bhat, 1986: xiii: 2) stated that the Śaka era commenced 2526 years after the period of Yudhisthira, who had been crowned at the end of the Great War. This makes the commencement of the Yudhisthira Era 2449 BCE. None of this helps us very much.

There also is a school of thought that the *Mahābhārata* was a historical event. Its period should lie between 1400 BCE and 900 BCE, and the epic would not have acquired its present form earlier than 400 BCE and later than 400 CE (Kochhar, 2000: Chapter 11; Winternitz, 1927(I): 475). Then there are those who have dated the War from the celestial circumstances mentioned in the epic. However, dates arrived at varied greatly, and are doubtful.

6 FINDING KING JANAMÉJAYA'S ECLIPSE

The eclipse in the Gauj grant is in *Chaitra* – the first month of the year, with Rāhu in *Aśvini* – the first *naksatra* in the lunar zodiac and the seat of the Vernal Equinox, on *Ravivāsare* (Sunday)—the first day of the seven-day week and a day Brahmagupta (598–668 CE) stated creation began on. The *karaṇa Kimstughna* (see Narasimmiyengar 1872: 377–378) is the first half-*tithi* of the *Śukla Pratipada* (S1) in the disposition of the sixty half-*tithis* in a lunar month. Added to these is the *Vyatipāta* (see Sections 8.1 and 8.2).

The grant uses a weekday. The earliest evidence of use of a weekday in India is in a Gupta Age inscription of King Budhagupta, dated 484 CE (Fleet 1912: 1044; Sen and Shukla, 2000: 294; Sewell 1924: xii). Traditionally, an eclipse happening on the weekday of the planet is named *Chūḍāmaṇi*. That is to say, a solar eclipse happening on a Sunday or a lunar eclipse on a Monday is *Chūḍāmaṇi*. A *Chūḍāmaṇi* eclipse was considered highly beneficial by the Hindus (Underhill, 1921: 36–37). This aspect is not hinted at in the grant though.

The grant speaks of the Sun in half-eclipse. Referring to Colebrooke (1809), Captain George Peacock (1805–1883), Master, Royal Navy, 1835, attempted to identify the eclipse. Using Struyck's Catalogue of Eclipses in Ferguson's *Astronomy*, Peacock (1867: 81) suggested that this was the eclipse of 3 April 889 AD:

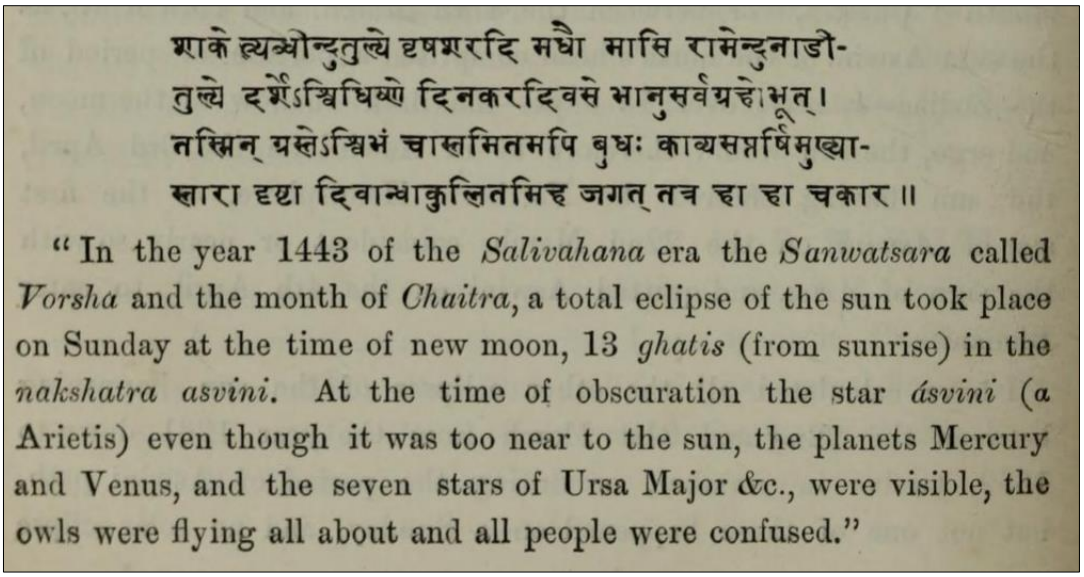
> Working out the Dominical Letter and Epact, according to the tables in the Prayer-Book and those given by Ferguson, it would seem to have been that named in Ferguson's *Astronomy*, at page 217, in Struyck's Catalogue of Eclipses, as having been observed at Constantinople on the 3d April, A.D. 889. The record on the third plate states that the Moon was in the "Nakshatra Aswini," which answers to the zodiacal sign *Aries*, and which would also coincide with the month "Chaitra", or between the 15th March and 15th April; as the sign Aswini, or the Horse's head, comprised apportion, or period of the zodiac, little over thirteen days, the dark shadow of the Moon, and therefore the Sun would be in Aswini on the 22nd March, coincident, or nearly so, with the sign Aries, and would quit Aswini on the 4th April to enter Bharani.

Peacock also computed all the other eclipses of the Sun from the year 1261 to 1699 that happened between 22 and 31 March, i.e., during the passage in *Aśvini*. He found twelve such eclipses, but none of these occurred on Sunday to answer the conditions. The eclipse of 889 CE, a partial, was on 4 April. The eclipse date in Struyck's Catalogue is possibly in terms of the astronomical day that begins at noon.

Citing Peacock's postulate, a correspondence commenced in the December 1867 issue of the *Proceedings of the Asiatic Society of Bengal*. Peacock's text had been communicated by Major R.R.W. Ellis from Starcross, near Exeter, through his letter of 20 November 1866. Major Ellis had formerly been the East India Company's Political Agent in Jhansi state in Bundelkhand, and later the Vice-President of the Delhi Archaeological Society. He asked if the pandits of India had any knowledge of the solar eclipse that occurred on 3rd of April 889 so that the identity of the eclipse Captain Peacock postulated could be established.

Responding from Benares, Pandit Bapu Deva Sastri (1821–1900; Figure 8), the renowned Sanskrit scholar and mathematician, presented his impressions through a letter dated

Figure 8: A photograph taken by Brajo Gopal Bromochary around 1870 showing Pandit Bapu Deva Sastri, Professor of Astronomy, teaching a class at Queen's College, Varanasi (Benaras), accompanied by an armillary sphere and a globe (Wikimedia Commons).



शाके ख्यब्धीन्दुतुल्ये वृषशरदि मधौ मासि रामेन्दुनाडी-
तुल्ये दर्शेऽश्विधिष्ण्ये दिनकरदिवसे भानुसर्वग्रहोभूत्।
तस्मिन् ग्रस्तेऽश्विभं चाखमितमपि बुधः काव्यसप्तर्षिमुख्या-
स्तारा दृष्टा दिवान्धाकुलितमिह जगत् तच्च हा हा चकार॥

"In the year 1443 of the *Salivahana* era the *Sanwatsara* called *Vorsha* and the month of *Chaitra*, a total eclipse of the sun took place on Sunday at the time of new moon, 13 *ghatis* (from sunrise) in the *nakshatra asvini*. At the time of obscuration the star *ásvini* (α Arietis) even though it was too near to the sun, the planets Mercury and Venus, and the seven stars of Ursa Major &c., were visible, the owls were flying all about and all people were confused."

Figure 9: The quote from the Hindu astronomer Ganeśa in Bapu Deva Sastri's letter describing the eclipse of 1521 CE (after Sastri, 1867: 174).

21 October 1867. It was addressed to Babu Rajendralala Mitra, an eminent orientalist and the "Hon. M. R. A. S. Phil. Secretary Asiatic Society, Bengal", from whom Sastri had received extracts of Major Ellis' letter. Sastri (1867: 174–175) contended that as per his own calculation, Peacock's eclipse actually occurred on Friday, not on Sunday. Further, citing from Major Ellis that "… no Solar eclipse took place in Asvini at any period except the 3rd April answering to Sunday …", Sastri contended that this was not the case as the great Indian astronomer Ganeśa Daivajna (b. 1507 CE), the author of the highly acclaimed work the *Grahalāghava* (epoch 1520 CE), had spoken of the solar eclipse of 7 April 1521 that had taken place on Sunday in *Aśvini*. He presented in his communication the relevant stanzas in Sanskrit, together with a translation, vide Figure 9.

The stanzas by Ganeśa give details about a total solar eclipse happening in the year Śaka 1443, *Samvatsara Vṛṣa* (15; Jovian South) on a Sunday in Aśvini, at the time of New Moon, 13 *ghatis* after the sunrise (1 *ghati* ≡ 24 minutes; 60 *ghatis* in a sidereal day and night). Sastri (1867: 175) contended:

> I have also calculated this eclipse, and found that Ganesa is quite right. The time of this eclipse answers to the 6th April (O. S.) or the 17th April (N. S.) 1521 A. D. Therefore, it cannot be supposed that the solar eclipse recorded on the grant of land occurred on the 3rd April, 889 A. D. because it fell on Friday and not on Sunday.

The name of Ganeśa's work from where the stanzas in Figure 9 were taken is not given; these stanzas are not there in the *Grahalāghava*.

Regarding the date of the possible eclipse, Cole (1872: 375) commented along similar lines. Cole was Superintendent of *Inām* Settlements, Mysore and in the course of his investigation into the *inām* locations in the Malnād talukas of the Nagar division, he had had a chance to inspect the three copper plate grants, namely the Kuppagadde, Gauj and Bhimana Katte Matha of the Kāvaledurga Taluks. He said that among these it was only the Gauj grant where a solar eclipse was alluded to, adding that

> A copy of this grant was sent some years ago by Sir Mark Cubbon to Colonel Ellis, who was then Political Agent at Bundelkhand. Colonel Ellis asserted that the solar eclipse alluded to in the grant was that of 1521 A.D., and drew the conclusion that the Janaméjaya alluded to must have been one of the Vijayanagar kings. Colebrooke denounced this grant as a forgery …

For his part, Colonel Ellis was convinced the grant was not a forgery (see Ellis, 1877) and for a long time he tried to locate information about Janaméjaya and the eclipse, from anywhere. In this regard, a few of his communications appeared in *Notes and Queries* in 1868, 1869 and 1877. At this time, *Notes and Queries* was a remarkable 'medium of intercommunication', devoted to "… the asking and answering of readers' questions …" It was published in London. Ellis' first two letters, both published in 1868, contain relevant information and are reproduced here:

THREE ECLIPSES — As calculated and drawn out by Shri Nat Veiaz, a Brahmin at Cambay, according to a Sanskrit MS. in the Fraser Collection, v. p. 37, Fraser's Nādir Shāh.
1. What memorable events were celebrated on the festivals of the different eclipses, Sun or Moon, above referred to, and what particulars are given regarding the Hindu days of the week and month on which they fell?
2. What account is given of the parentage of Shri Nat Veiaz of Cambay, and can be identified with Vyāsa, the celebrated astronomer, who officiated at a sacrifice held at Harihara, in Western India, on an eclipse of the sun visible in Europe on April 7, A. D. 1521?
3. What date is affixed to the work? Who was the ruling authority at the time in Gujrāt, and what account is given of the chief to whom it is dedicated? R. R. W. ELLIS. Starcross, near Exeter. (Ellis, 1868a).

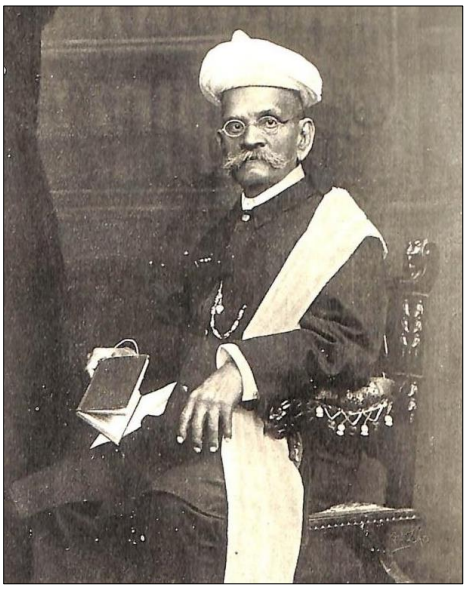


Figure 10: Ramakrishna Gopal Bhandarkar (Wikimedia Commons).

THE SOLAR ECLIPSE OF APRIL, A.D. 1521. — According to computations made by the Rev. G. B. Gibbons, B. A. of Laneast, Launceston, this eclipse was visible at Harihara, lat. 14½ N., long. 76° E., about 11 o'clock, on Sunday morning, April 7, A.D. 1521, and, as seen there, was large, but not total. Will any of your many valuable correspondents be kind enough to say whether any record of this particular eclipse is to be found in Portuguese works of history, or travels in the British Museum or other public libraries, either at home or abroad? R. R. W. ELLIS. Starcross, near Exeter. (Ellis, 1868b).

We note that over Harihara, the eclipse of 7 April 1521 was partial and reached a magnitude 0.88. Later, Bhandarkar (1875: 81) commented on the opinion of (the then) Colonel Ellis that if one considered the *Mahābhārata* rather recent, the grant did not have to be considered spurious. Ellis believed that the solar eclipse that the grant makes reference to was that of 7 April 1521 as calculated by the Reverend G.B. Gibbons and Professor G.B. Airy, and that the Janaméjaya of the grant was Appāji, a Minister of the renowned conqueror Krishṇa Rāya (Krishṇadevarāya, Emperor of the Vijayanagara Empire; 1471–1529; r. 1509–1529).

Sir Ramakrishna Bhandarkar (1837–1925: Figure 10) was a social reformer, an eminent scholar and a great orientalist; the Bhandarkar Oriental Research Institute was founded in 1917 in his honour. Bhandarkar (1875: 81) provided ample proof to establish the antiquity of the *Mahābhārata*, and he refuted the naïve inference Colonel Ellis had drawn about the grant. Not giving up, Colonel Ellis continued to hold his opinion about the Gauj grant—vide another letter in the *Notes and Queries* of 6 January 1877 (Ellis, 1877: 13). Here, he contended that as the Gauj grant was dated to the solar eclipse of 7 April 1521, in the 111th year of the Śaka Yudishthira, the Yudishthira era (or Kaliyuga) must have commenced in 1410 A.D., i.e., 4,420 years subsequent to the period traditionally assigned to it.

Interestingly, Rice (1902: 1) placed on record a few more grants attributed to King Janaméjaya, namely, the grants from Siralkoppa and Kodanganur, and Kadur Taluka (e.g., Inscription no. 66 in Rice, 1901: 40–43). Born in Bangalore, Benjamin Lewis Rice (1837–1927; Figure 11), a British historian, educationist and archaeologist, is referred to as the Father of Kannaḍa Epigraphy and remembered for his monumental work on the inscriptions in Sanskrit and Kannaḍa in the State of Mysore that constitute the bulk of *Epigraphia Carnatica* (e.g. see Rice, 1901; 1902; 1974) and the *Mysore Gazetteer*.

Rice (1879: 89–98) had deliberated over two Chālukya grants, one of which professed to date to Śaka 366 and belong to the time of Vira Noṇamba; the latter has been described as "... the sun of Chālukya kula." The Noṇamba grant is on three copper-plates, with a seal. According to Rice, the inscription is in characters identical with those in the Gauj inscription and resembles the other three attributed to King Janaméjaya, i.e., the Begur, Kuppagadde and Gauj grants. Rice wrote about all four grants,

and pointed out the identical parts that they had. The solar eclipse is mentioned in only the Gauj grant, and, the *Vyatipāta* is mentioned in three except in the Noṇamba grant. Rice concluded that all of the grants had been inscribed after one model. Although the Noṇamba grant was referred to the Chālukya Dynasty and the other three to the Pāndya Dynasty, he believed that they all belonged to the same period. He referred to Vira Noṇamba describing himself as "… prince of the world-renowned Pallava race and head jewel of the Chālukyas." The period of the grants was not easy to decipher but judging from the characters engraved and the coincidences in the names, Rice (1879: 98) reasoned that the grants belonged to the twelfth century, and were made by a common descendant from an alliance of the Chālukya and Pallava families. By referring to the *Kaṭapayādi* notation,[1] he deduced the year as Śaka 1115, expired. Noting from Struyk's Catalogue of Eclipses that there was a partial solar eclipse on 22 April 1194, he suggested the year AD 1194 as the probable year of the grants. However, this eclipse was on a Friday.

Later, Rice (1902) returned to the Gauj Agrahāra Plates 'Sk. 45 (Shikarpur 45)' to ascertain their period. Earlier, he had noted that though the Gauj grant was brought to light by Colonel Mackenzie in 1807, the plates were in fact mentioned in 1746 in a *sannad* (testimonial) by Chennamāji, Queen of Bednūr (Rice, 1879: 92). A *Sannad* is a charter or a grant. The grant gives the village name as Gautama Agrahāra. Rice (1902: 3) was of the opinion that in determining the period of the grants, traditions were of no help. They also did not have the required data:

> It has been proposed to derive the year from the phrase, *kaṭakam utkalitam* which immediately precedes the month and the day, – just in the place where the year should be given if mentioned, – by applying the *kaṭapayādi* system to the first word,[1] resulting in 1115 (Śaka) expired, i.e., 1193 A.D., and for many reasons this date seems not to be far wrong. The day is given as Monday, the third of the dark fortnight of Chaitra, at the time of *sankrānti* and *vyati-pāta*. To this Gauj adds a partial eclipse of the sun. From data which Colebrooke furnished to the Astronomer Royal, Sir G.B. Airy, the latter calculated that the solar eclipse mentioned occurred on Sunday, the 7th of April 1521.[2] But he was evidently not informed of Monday being the weekday, as it is broken off in the Gauj inscription, being at the edge of the plate. Hence this estimate, though accepted at the time on such high authority, cannot be relied upon. We may safely take as a guide the period of Vira-Noṇamba, the Chāḷukya prince Jayasiṃha, which is known, the end of the 11th century; and assuming that his grant was the model for the others (to which the similar terms and signatures bear witness), we have to allot these to some king suggestive of the Pāṇḍavas and connected with Harihara. These requirements are met by the Pāndya kings of Uchchaṅgi, of whose inscriptions there are several at Harihara. From Sk- 99 it appears that early in the 12th century they were governing Konkaṇa, but later on were governors of the Noḷambavādi Thirty-two Thousand and the Sāntaḷige Thousand (Ci. 61, 39). Vijaya-Pāṇḍya, ruling in about 1166 to 1187, for part of the

Figure 11: Benjamin Lewis Rice shown on the 184th Birth Anniversary commemorated by Karnataka Department of Tourism (image adopted from @KarnatakaWorld, 17 July 2021).

time seems as if independent. The Chalukya power had been now overthrown by the Kalachurya usurpation. The Hoysalas under vira-Ballala, and the Sevuṇas or Yādavas of Devagiri under Jaitugi, were contending for the possession of the late Chālukya territories. The Cholas had besieged without success for twelve years the impregnable Pāndya Stronghold of Uchchangi and abandoned it, – which Ballāḷa then captured, re-instating Pāṇḍya on his claiming protection. The Lingāyit revival in the time of the Kaḷachurya king Bijjaḷa had spread with alarming rapidity throughout the Kannada-speaking countries, superseding the Jains and ousting the Brahmans from their

pre-eminence. The times were thus full of great political and religious convulsions, which might well furnish ground for the apprehension that led to the assignment of a fabulous antiquity to these Agrahara grants, their real period being the 12th century.

1. *Utkalitam* would mean counted or reckoned up; calculated. If only *kaṭaka* be taken, we get 111, which, in the Chāḷukya Vikrama era, then in use, yields 1187 A.D., or nearly the same. Vira-Noṇamba's grant contains this phrase as well as the Śaka year, but has utalitam, not utkalitam.
2. Journal Bo. Br. R. A.S., X, 81.

In the quote above, Sk. = Shikarpur, Ci = Channagiri. The respective inscriptions are detailed in Rice (1902). The second footnote in the quote is actually a reference to Bhandarkar (1875).

We will return to the suggested date by Rice (1902: 3), but before that the solar eclipse of 7 April 1521, a *Chaitra-Aśvini-Sunday* eclipse, needs to be explored that Rice (1879: 93; 1902: 3) had disfavoured saying that the day mentioned in the grant be regarded as Monday where the day part is broken off in the last line of the original Gauj plate *Ib* (Figure 4**)**. However, we take the day of the eclipse as Sunday, in step with Colebrooke (1809: 447n), who noted that

> Such is the deduction from the text, which states a half eclipse of the sun in Chaitra, on the sun's entrance into the Uttarāyana, or northern part, at the moment of Vyatipāta (which imports new moon on a Sunday in any one of the undermentioned Nacshatras, viz. Aswini, Sravanā, D'hanisht'ha, Ardrā, Astésha, and Mrigasiras: the first of which is the only one compatible with the month).

7 THE GREAT INDIAN ECLIPSE OF 1521

The total solar eclipse of 7 April 1521 (Śaka 1443) was visible from India, and the path of totality crossed Maharashtra, Madhya Pradesh and Uttar Pradesh. Over Gauj (Gowthamapura; 14.146° N, 75.221° E), this eclipse was partial but it reached a maximum magnitude of 0.887. Since this eclipse was suggested as the possible Gauj Agrahāra grant eclipse, we will look into the observations of the eclipse by Ganeśa that Bapu Deva Sastri (1867) reported, as shown in Figure 9.

Ganeśa was the prodigious son of Keśava II, who was himself an acknowledged astronomer. Coming from an exponent and practitioner of Hindu astronomy, Ganeśa's is an exceptional record of an eclipse in pre-nineteenth century period because it carries a phenomenological description of the event. So, where was Ganeśa, then aged 14, located? According to Dikshit (1981(II): 128), his family resided in Nandigrāma (present day Nandgaon) on the Konkan coast, about 40 miles south of Bombay. Sarma (2010: 571) gave the geographical position of Nandgaon as 18° 22' 60" N and 72° 55' 0" E. During Ganeśa's time, Nandgaon was under the Dynasty of Nizām Shāhi, who ruled over the Sultanate of Ahmednagar in Maharashtra.

For over a millennium, solar eclipses have been an important subject of study in Indian astronomy. To predict an eclipse, one needed to be proficient in relatively advanced geometry, have access to a reliable chronological system, and possess knowledge or observations of a series of eclipses. The Nandigrāma region was home to astronomers and mathematicians, and flourished between the thirteenth and eighteenth centuries. We may assume that they were aware of the forthcoming instances of syzygy (the *parva*) and even refined their parameters and calculations when eclipses happened. Over this period, Nandigrāma witnessed two total solar eclipses, on 6 November 1268 (2 m 51 s) and 7 April 1521 (5 m 10 s), and two annular eclipses, on 15 December 1610 (6 m 29 s) and 16 January 1665 CE (9 m 28 s) respectively.

In 1521, the Nandigrāma astronomers should have known that a rare solar eclipse was imminent, as it was listed in the *Chaitra-Aśvini-Ravivāsare*. A fortnight earlier, there was a penumbral lunar eclipse on 23 March 1521, with greatest eclipse being at 04:07 UT. A penumbral is a 'no-eclipse' in Indian classical astronomy but the astronomers would have known that the Moon was about to pass a critical syzygy.

The 1521 eclipse was total over Nandigrāma. A closer view of the path of totality, resized from Espenak (2023), is given in Figure 12; the red line is the central line. Nandigrāma (18.387° N, 72.929° E), shown by the marker, is right on the coast. It was about 3.5 km north of the central line of the path of totality, itself about 230 km wide (the Moon was then at 57.1 Earth Radii—i.e., close to perigee). The path of totality crossed prominent places such as Mumbai, Pune and Nashik, whereas Ujjain, Prayagraj and Varanasi, for instance, missed it by a small distance.

In Table 1 the eclipse circumstances over Nandigrāma are presented, extracted from Espenak (2023). The vantage point is the Siddhi-

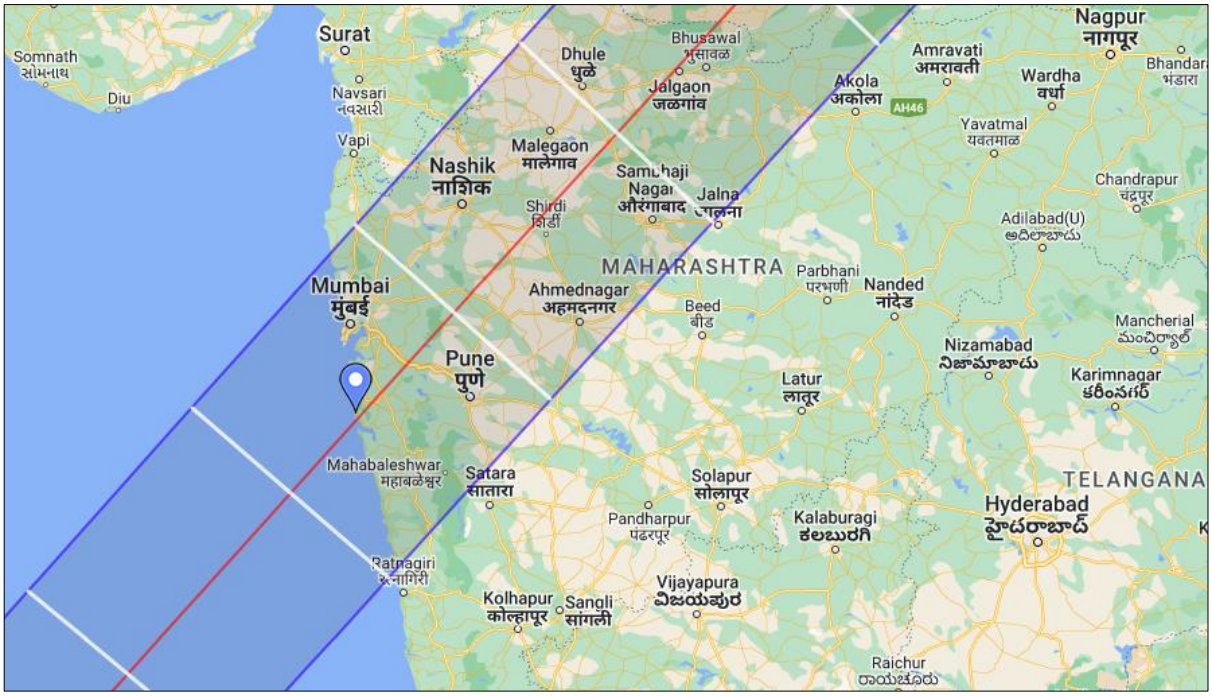


Figure 12: A map showing the path of totality of the solar eclipse of 7 April 1521 CE. The marker indicates Nandigrāma (Nandgaon; 18.387° N, 72.929° E) and the red line is the centre line of the path of totality (the map of coastal Maharashtra is re-sized from the Google Maps in Espenak, 2023; map modifications: R.C. Kapoor).

Table 1: The solar eclipse of 7 April 1521 over Nandigrāma.*

Event	Contact	Time (UT)	Alt (°)	Azi (N-E) (°)
Partial eclipse begins	C1	04:49:09.1	55.5	98.8
Total eclipse begins	C2	06:04:32.0	72.7	115.8
Mid-eclipse		06:07:06.9	73.2	116.9
Total eclipse ends	C3	06:09:42.5	73.8	118.0
Partial eclipse ends	C4	07:30:17.6	80.2	214.7

* Totality: 5m 10.5s; magnitude: 1.032; obscuration: 1.000

vināyaka Temple (18.387° N, 72.929° E) in Nandigrāma, which is our arbitrary choice. The eclipse was mostly ante-meridian.

Figure 13 recreates the sky above Nandigārma on 7 April 1521 at the time of maximum eclipse. The planets Mercury, Venus and Saturn were up in the sky whereas Mars and Jupiter had set. Venus, at an eastern elongation of 40° and shining at visual magnitude of -4^m would have been easy to spot. Mercury, at magnitude -2.3^m was bright enough but was at a solar elongation of only 0.7° and was about to pass superior conjunction a few hours later. Since the brightness of the solar corona falls off exponentially, even though Mercury was just one solar diameter away from the solar limb in principle it was spottable. However, in a sky plunged into sudden darkness, the human eye needs time to adjust and initially can only spot a star-like object if one knows exactly where to look. Meanwhile, as a bright star nearest the ecliptic, *Rohiṇī* (Aldebaran; $+0.75^m$ to $+0.95^m$) also was up there to be noticed (it is not in Figure 13), being East of the eclipsed Sun and at a comfortable elongation of ~38°.

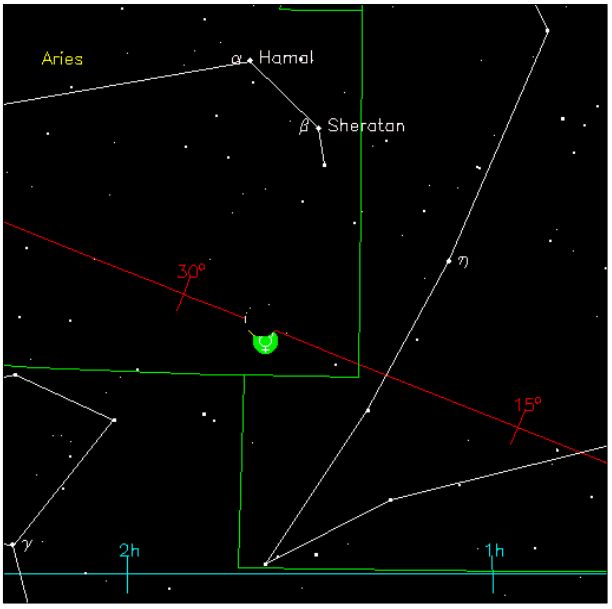


Figure 13: The Aries region on 07 April 1521 at maximum eclipse, showing a 25° field. Mercury (the green circle), was then very close to the Sun and is not well resolved here. The red line is the ecliptic and the blue line the Equator (image generated from *Your Sky*).

The star α Arietis (for Aśvini in Sastri's translation) was high up, on the north-eastern side of the eclipsed Sun, at a solar elongation 11° (precessed). However, the star is not very bright, its visual magnitude being +2^m. The sky at the time of totality is like it is at twilight—say, about 30 minutes before sunrise or after sunset, but dark enough to see the first magnitude stars and the visible planets. Near the eclipsed Sun, the general scattering of light in the sky will almost drown out a star fainter than +1^m. In a hazy sky, the situation gets worse. Therefore, one would really need to look hard to ascertain where a planet or a particular star might actually be in order to confirm seeing it. Note that, at the moment of totality, the seven bright stars of Ursa Major had already sunk below the horizon, and were no longer visible as stated in Ganeśa's stanza. Instead, the much dimmer constellation of Ursa Minor was up. At this time the star Polaris (+2^m), was 3° from the North Celestial Pole, at an altitude of 21° (Nandigārma's latitude was 18.387° N). As for the weather, we can assume that the sky was clear.

Ganeśa gave the New Moon time as 13 *ghatis* (≡ 5h 12m) after sunrise (Figure 9). The timings of *sparsha* and *moksha* (contacts C1 and C4) are not provided in Sastri's (1867: 175) quote. As per *Pancanga3.14*, the sunrise time for Nandigrāma's coordinates was 5 h 47 m, equivalent to 00:17 UT, so the maximum eclipse occurred at 05:29 UT. As per the modern computation (*Your Sky*), the sunrise time was 00:50:34 UT. Adding 13 *ghatis* gives the maximum eclipse time as 06:02:34 UT. The corresponding figure per Espenak (2023) is 06:07:06.9 UT (Table 1).

Being based at Nandigrāma for so long and observing, the astronomers' location becomes their prime meridian. The epoch of the *Grahalāghava* is *Phālguṇa Amāvasyā*, Śaka 1441 at sunrise. This is equivalent to Monday 19 March 1520 CE, implying that their astronomical constants were up-to-date at the time of the eclipse. In Figure 12, we see the umbral path over the West Coast of India inclined by about 45° relative to the Equator. At the latitude of Nandigrāma, the western and eastern boundaries of the path of totality were ~3° (i.e. 300 km) apart in longitude, and the best vantage point lay nearly midway between the two. Since Nandigrāma did observe a total eclipse we believe that any discrepancy in the calculated *sparsha* / *moksha* (C1 / C4) timings cannot have been more than ~12 minutes in time (i.e., half a *ghati*). During the several minutes of totality, the eclipse of 1521 gave observers an opportunity to cross-check their calculated positions for the true places of the planets, but particularly the Moon and the node (*Rāhu*).

We do not know if any traditional equipment was used for the observations, e.g., a *Gola-yantra*, *Śaṅku* (gnomon), *Nalaka-yantra* (viewing tube with possibly a mount) or a *Ghatikā-yantra* (water clock). The gnomon, a round wooden rod 12-angula long, would have allowed an observer to determine the East–West direction, their latitude and local time from the position of the solar shadow (Dikshit, 1981(II): 224; Ôhashi, 1994). An idea about the accuracy of some Indian astronomical instruments comes from the experiments that Sriram and Venkatesh recently carried out. In their experiment with the gnomon, they noted a discrepancy of 1.5° in the latitude of Chennai. This arose because the gnomon may not have been exactly vertical (Sriram and Venkatesh, 2019: 20).

We can only admire the astronomers for the very idea to observe the Sun during an eclipse when people typically remained indoors for various reasons. An important aspect here is the first contact bias, because the time of detection of an eclipse is subjective. Most people only notice that an eclipse is in progress when the Moon has covered ~85% of the Sun's disc. The temperature falls by several degrees; birds head for their nests, nocturnal bats appear and animals act strangely. The situation starts to get scary and eventually stunning. The last minute before the beginning of totality and the one just after it are the most dramatic. The surroundings get dark and as the Sun's light disappears, the corona suddenly flashes before one's eyes as a tenuous white cloud-like form around the dark solar disc. There is a drop in brightness by a factor of ~400,000 and, in the darkened surroundings, the corona shines with a brightness like that of the Full Moon. The sky turns bluish-grey, and the planets Venus and Mercury and a few bright stars may be seen. Before one can overcome the sensation and appreciate the ethereal beauty, the scene ends by giving way to a burgeoning diamond ring, literally a *Chūḍāmaṇi* eclipse. The impact of a total eclipse on viewers is profound and lasting, and anecdotes loaded with the sensational experience travel far and wide. Given these circumstances, an unprecedented and unexpected darkness at noon would certainly cause confusion. In the present case, it was best mirrored in Ganeśa's own words, that there was "*Jagata tatra Hā hā chakāra*" (uproar all over the world).

Ganeśa was 14 when this eclipse took place, but we believe that he wrote the Sanskrit stanzas (Figure 9) describing the observations much later, and from memory. Be that as it may, 'The Great Indian Eclipse of 1521' qualifies as the most important eclipse in the history of pre-nineteenth century Indian astronomy where a

total eclipse was actually observed by the traditional astronomers *and* written about. There is no similar record preserved by any other classical Indian astronomer who witnessed a total solar eclipse.[2]

8 THE ECLIPSE IN THE GAUJ GRANT

Requiring an eclipse to be in a particular month, *naksatra* and day of the week makes it rare. The Gauj inscription makes it still rarer by adding the circumstances like the *Vyatipāta* (pāta – aspect), and the specific *naksatra* and *karaṇa* on the following day.

8.1 The *Vyatipāta*

The term *Vyatipāta* refers to the instance when the Sun and Moon have an equal declination in magnitude with respect to the equator (see Burgess 1860: Chapter xi). This equality indicates the position of *Rāhu*, the ascending node, and the possibility of an eclipse visible at a particular place on the Earth (see Shylaja and Ganesha, 2016: Chapter 7; Vahia, 2015: 66). The astronomers were able to ascertain the *Vyatipāta* from observations. It was considered an equally pious occasion for charity. Shylaja and Ganesha (2016: 61) have examined more than one thousand documentations from South India, more specifically in and around Karnataka. They found *Vyatipāta* records aplenty, first met with in stone inscriptions from the ninth century, largely from the tenth to the fourteenth centuries, but hardly any after the sixteenth century. This is an important deduction and helps us narrow the time-window within which the Gauj grant can be placed.

8.2 The *Karaṇas*

The Hindu *Panchānga*, the traditional almanac, is made of five limbs, the *tithi* (lunar day), *naksatra* (lunar mansion), *vāra* (weekday), *yoga* (sum) and *karaṇa* (half-*tithi*). The lunar month is divided into thirty parts, called *tithi*. This is a duration over which the Moon gains 12° over the Sun. *Amāvasyā* is the 30th *tithi*. The *naksatra* gives the position of the Moon in a lunar asterism. As a *naksatra* has a longitudinal spread of 13° 20′, it can be found by dividing the Moon's longitude by 13°.3333… The days of the week are counted from sunrise to sunrise. A *Yoga* is the sum of the longitudes of the Sun and the Moon divided into 27 equal parts. A *karaṇa* is a time unit, half the duration of a *tithi*. A *karaṇa* is completed when the Moon advances by 6° towards the Sun. There are eleven *karaṇas*. Four of these are named the *Sthira Karaṇas* (*Śakuni*, *Chatuşpāda*, *Nāga* and *Kimstughna*). These are immovable whereas the rest (*Bāva*, *Bālava*, *Kaulava*, *Taitila*, *Gara*, *Vaṇji* and *Vişti*) are movable. The *Sthira Karaṇas* are described thus:

> In the particular four half-*tithis*, viz., the second half of *Krsṇapaksa* (i.e., *Bahula*) *Chaturdaşi*, the two halves of *Amāvasyā* and the first half of *Pratipat* are the Sthira Karaṇas. (Rao, 1999: Chapter 6).

Thus, the first half of the first *tithi* in a lunar month, i.e., the *Śukla Pratipada* (S1), is *Kimstughna*, the next half is *Bāva*, etc. In a lunar month, the *Sthira Karaṇas* occur in a cyclic order once. The rest repeat in a cyclic order eight times. Chatterjee and Chakravarty (2000: 301–302) provide in their Table 9.10 the *karaṇas* related to the half-*tithis* of a lunar month. This concept was introduced around 400 CE, but it was in use even before the week-days came to be used (Dikshit, 1981(II): 275).

8.3 *Chaitra-Aśvini-Ravivāsare* Eclipses over Gowthamapura

Choosing the window 601–1699 CE, we searched for solar eclipses that answered the circumstances given in the Gauj grant. We used *Pancanga3.14* by M. Yano and M. Fushimi. This calculation can be made for a specific geographical location, and can be based on the *Suryasiddhānta* (*SS*; ca. 1000 CE), or on older astronomical constants in the *Pancasiddhāntikā* (505 CE). Here, the months are *Āmānta*. In our search, *Chaitra-Aśvini* eclipses turned up at an interval of 8–9 or 18–19 years. Of these, the eclipses that occurred on a Sunday are fewer in number. We found fourteen such eclipses within the date-window. These are listed in Table 2.

The eclipse dates in Table 2 are, respectively, in Common Era, Śaka and Vikrami Saṁvata (V.S.). Requiring that the next day's (Monday) *naksatra* be *Bharaṇi* and the *karaṇa* be *Kimstughna* leaves us with six eclipses only, those of 712, 739, 851, 1027, 1372 and 1548 CE, and they are bold-faced in Table 2. Among the rest, the next day's *karaṇa* is *Bāva*, except for the eclipse of 1697 where the next day's *karaṇa* is *Bālava*.

The values of ΔT in Table 2 are in seconds. ΔT is the difference between Terrestrial Time (TT), a uniform time scale, and Universal Time (UT), measured with the rotation of the Earth. The timings of a future / past eclipse are computed with respect to the predicted value of ΔT. However, the rotational slowing of the Earth is not a constant. It may actually be a slightly increased or decreased value on the day of the eclipse. The change affects where accuracies to the last few seconds matter, e.g., close to the edge of the path. As the Earth rotates close to half a kilometre / sec at Equator, and a third of

Table 2: *Chaitra-Aśvini-Ravivāsare* eclipses between 601 and 1699 CE.

Yr	M	D	Śaka	V.S.	*Karaṇa*	Days in Mesa	*ΔT* (sec)	Type	Where Visible	G (Y/N)
675	4	1	597	732	N	13	4011	A	Australia	N
702	4	2	624	759	N	14	3768	A	Antarctic	N
712	**4**	**10**	**634**	**769**	**C**	**22**	**3679**	**P**	**Antarctic**	**N**
739	**4**	**12**	**661**	**796**	**C**	**23**	**3443**	**A**	**Pacific**	**N**
851	**4**	**5**	**773**	**908**	**N**	**15**	**2534**	**A**	**India**	**Y**
1000	4	7	922	1057	N	17	1558	T	India	Y
1027	**4**	**9**	**949**	**1084**	**C**	**18**	**1414**	**P**	**Arctic**	**N**
1074	3	30	996	1131	N	7	1188	P	Antarctic	N
1196	3	31	1118	1253	C	8	738	A	South Atlantic	N
1345	4	3	1267	1402	N	9	402	P	Antarctic	N
1372	**4**	**4**	**1294**	**1429**	**C**	**10**	**358**	**H**	**S America, Atlantic**	**N**
1521	4	7	1443	1578	N	12	174	T	India	Y
1548	**4**	**8**	**1470**	**1605**	**C**	**13**	**151**	**P**	**Arctic; N America**	**N**
1697	4	21	1619	1754	N	14	8	T	India	Y

*KEY:
Karaṇa: N = Nāga; C = Chatuspada
Type: T = Total; A = Annular, H = Hybrid;
G = Gowthamapura; Y/N indicates if Gowthamapura fell within the (pen)umbra.

Table 3: Three of the *Chaitra-Aśvini-Ravivāsare* eclipses between 601 and 1699 CE.

Eclipse Date			*Suryasiddhānta* (ca. AD 1000)		*Pancasiddhāntikā* (AD 505)	
Year	Month	Day	*Naksatra*	*Karaṇa*	*Naksatra*	*Karaṇa*
0851	4	5	Aśvini	Nāga	Aśvini	Nāga
	4	6	Bharaṇi	Kimstughna	Bharaṇi	Bāva
1196	3	31	Aśvini	Chatuspada	Aśvini	Nāga
	4	1	Aśvini	Kimstughna	Bharaṇi	Bāva
1521	4	7	Aśvini	Nāga	Aśvini	Nāga
	4	8	Bharaṇi	Bāva	Bharaṇi	Bāva

km / sec at the mid-latitudes, etc., a change in the predicted *ΔT* from the up-to-date value by a few seconds can shift the edge of the path. If it is less than the predicted value, the path would fall slightly westward and *vice versa*.

There are two other grants, respectively listed in Subbarayappa (2015: 27) and in Shylaja and Ganesh (2016: 114), connected with the eclipses of 851 CE and 1521 CE, and details of these are presented in Note 3.

9 DISCUSSION

It is important to have a look at some of the eclipses in Table 2. The Pancanga3.14 calculations presented were based on the *Suryasiddhānta* and made for the location of Gautamagrāma (Gowthamapura; 14.146° N, 75.221°E). The bold-faced eclipses are those where the next day's *nakshatra* is *Bharaṇi* and the *karaṇa* is *Kimstughna*. We have repeated the *Pancanga3.14* calculations based on the older constants in the *Pancasiddhāntikā* (505 CE) and cross-checked. In twelve cases, the results match for both the days, i.e., Sunday and the following Monday. There are two mismatches, shown in Table 3. Since the eclipse of 1521 evoked great interest among astronomers across the continents, we have included it here just to underline that it actually fails to meet some of the Gauj grant criteria. In its case, the following day's *karaṇa* is *Bāva* that is actually next to *Kimstughna* in the *karaṇa* sequence.

In the *Pancasiddhāntikā* system, the eclipse of 851 does not fit the Gauj circumstances. In the light of history of the region also, this eclipse is a misfit. As evident from Table 2, the eclipses that occurred nearest the suggested period of the Janaméjaya grant (Rice, 1902: 3) are those of 1027 and 1372 CE.

The eclipse of 9 April 1027 was partial, not visible over India. Since the inscription talks about *Vyatipāta* and an eclipse, it had to be an eclipse where the two events were not far apart in time. For the location of Gowthamapura, we find that the *Vyatipāta* moment happened on 9 April at 08:07 UT when the respective declinations of the Moon and the Sun were equal in magnitude. At that moment (post-meridian in India), the Moon's elongation was ~5° west of the Sun. *Vyatipāta* implied that an eclipse was imminent. The penumbra in this eclipse actually fell over high geographical latitudes and largely over the Arctic Ocean. The greatest eclipse (GE) occurred at 71.373° N and 170.364° W in the Arctic Ocean, north-west of Alaska, at 15:21:15.5 UT. Gowthamapura lay well outside the penumbra. With respect to the history of that region, this eclipse should not be ignored.

The solar eclipse of 31 March 1196 CE figures in both Tables 2 and 3. It evokes special interest because it dates closest to the period of

the grant suggested by Rice (1902: 3). However, the eclipse does not meet the circumstances specified in the Gauj grant. In the SS based calculation, the next day's *karaṇa* is *Kimstughna* but the *naksatra* is still *Aśvini* (Table 3). In the *Panchasiddhāntikā* based calculation, the *naksatra* on the following day is *Bharaṇi* but the *karaṇa* is *Bāva* (that comes after *Kimstughna* in the cycle). The eclipse of 4 April 1372 CE was a hybrid. In this case too, the Moon's shadow eluded India. The *Vyatipāta* condition obtained about an hour later than the moment of the Greatest Eclipse (16:03 UT), i.e., after the New Moon. The last of the qualifying eclipses, that of 8 April 1548 CE, was not visible over India. Its penumbra was confined to the northernmost latitudes, much like the way it was in the 1027 eclipse. The Greatest Eclipse happened at 71.2174° N, 156.5098° W, near Utqiagvik at 14:07:25 UT. The *Vyatipāta* happened about seven hours earlier, at 07:15 UT.

Needless to say, the *Vyatipāta* timings given in this Section are calculated; the inscriptions do not have the *Vyatipāta* timings.

10 CONCLUDING REMARKS

There are four copper-plate records from Karnataka's Shimogā district or the surroundings claiming grants of land purportedly made by the *Purāṇic* King Janaméjaya (Cole, 1875; Fleet, 1901; Rice, 1879). They all are from the neighbourhood, inscribed after one model and therefore should belong to the same period. Rice (1879: 98; 1902: 3) assigned the cause of the attribution to major political upheaval and religious reforms in the region in the late twelfth century threatening the supremacy of the Brahmans, who therefore made certain *agrahāra* grants by claiming 'fabulous antiquities'.

Purāṇic references are not possible to date. Any dating with reference to the *astronomical Kali* era is absurd. A similar problem arises with the interpretation of the phrase *katakamutkalita* that appears in the inscriptions and was interpreted according to the *Kaṭapayādi* notation for fixing the period of the grants. It means either the Śaka year 111 or 1115. On the other hand, the phrase could also mean "… having halted the army …" (Rice, 1879: 92) or "… a camp was pitched …" (Fleet, 1901: 220). Deliberating over the phrase, Rice (1902) favoured the expired Śaka year 1115 (i.e., 1193 CE) as the year of the Gauj grant. However, if the purpose was to claim antiquity, giving a current date would have been self-defeating.

Among the Janaméjaya grants, only the Gauj Agrahāra grant is associated with a solar eclipse. The astronomical circumstances for the day of the eclipse and the following day make it a rare one. As there is no solar eclipse mentioned in the Janaméjaya legend in the *Mahābhārata*, was the eclipse in the Gauj grant real or an invented one? There were attempts made in the late nineteenth century to identify the eclipse, but the dates that were suggested, namely 889 and 1521 CE, were not convincing.

We have relooked at these identifications and also widened the search-period to 601–1699 CE. We found fourteen *Chaitra-Asvini*-Sunday eclipses, including that of 1521 CE. There were only six eclipses that fulfilled the condition of next day's *nakshatra* and *karana*, and they were the eclipses of 712, 739, 851, 1027, 1372 and 1548 CE. Except for the eclipse in 851 CE, none of these was visible in the relevant region of India, and none around the suggested time period. Perhaps the beneficiaries of the grant were apprehensive because they felt that it lacked sufficient rigour, so they introduced a 'text-book eclipse' with extraordinary circumstances, or one that imitated an eclipse from the recent past. Fleet (1901) has also suggested that the content of the Gauj grant may have been prepared as an imitation of the Talgund records from the eleventh to the twelfth centuries. Therefore, the nearest suitable eclipse that may have provided the inspiration was that of 1027 CE.

There was also the eclipse of 1196 CE near Rice's date. It was a *Chaitra-Asvini*-Sunday eclipse, but short on one of the conditions for the next day. Being too recent, it would easily give away the act unless the authors chose to 'tweak' its circumstances. That is unlikely but cannot be ruled out. The claimants knew that people believed that King Janaméjaya existed at the turn of the *Kaliyuga*, and also that the plates would quickly age and be accepted if ever an occasion arose to query their origin.

Whether a solar eclipse actually occurred or not, we need to admire the astronomer who came up with the intriguing solar eclipse association for the Gauj grant, thereby providing us with so interesting yet baffling a case study.

11 NOTES

1. The *Kaṭapayādi* notation, referred to in the quotation, is for the depiction of numbers in letters and words for ease of remembrance. It was popular among the Hindu astronomers, especially in the southern regions. "The ten digits are denoted by the letters in the groups (of ten each) beginning with *ka*, *āa*, *pa*, *yā*, the end letters alone being taken in the case of conjunct syllables." (Subbarayappa and Sarma 1985: 47–48). For an excellent exposition on the *Kaṭapayādi* notation, see Sarma (2012).

2. The *Siddhantadīpikā* and three other works by Parameśvara (ca 1370–ca 1460), the disciple of the renowned mathematician and astronomer Mādhava (ca. 1350–1425) of Sangamagrāma, refer to the solar and lunar eclipses that he himself observed from the banks of the river Nīla between 1393 and 1448 CE (Pingree 1981: 49; Puttaswamy 2012: 588; see also Hari, 2003). There are observations of thirteen eclipses, eight solar and five lunars.

   Nīlakantha Somayājī (1444–1545), famous for the *Tantrasamgraha* (1501 CE; Ramasubramaniyan and Sriram, 2010: 331–333) is the other astronomer to mention here. In his work *Jyotirmimāmsa*, he stressed the need to undertake astronomical observations to improve upon the parameters used for the computations and to refine the methodologies and the algorithms. He found that the observed time of occurrence of eclipses did not match the timings computed with the *Āryabhatean* parameters.

3. There are two other grants, listed in Subbarayappa (2015: 27) and Shylaja and Ganesha (2016: 114) respectively, executed on the occasion of the eclipses of 851 CE and 1521 CE, both of which are included in our Table 2. The eclipse of 851 CE was annular but its path ended over western India. From Gowthamapura the eclipse would have been partial when it commenced just around the time when the Sun's altitude dropped to h ~3.4°.

   About the eclipse of 1521, Subbarayappa (2015: 27) referred to an inscription found in Kodihalli in Mysore district, numbered Gu. 156 in *Epigraphia Carnatica* (Volume III, Revised), and he cited the grant made on the occasion of the eclipse of 7 April 1521. There is a date problem here. Gu. is for Gundlupete Taluka in the district and the grant was made by King Vira Krishṇarāya of Vijayanagara, and as per Rice (1974: 126–127), possibly by Krishṇadevarāya, Emperor of the Vijayanagara Empire (1471–1529; r. 1509–1529). Notably, the inscription mentions the date "Śaka 1444 [current], Vishu, Pushya ba[di] 30, Saturday, Makara-sankrānti, solar eclipse, Bhāskara nakshtra." The corresponding date has been given as "… 28th December, 1521 A.D., *Purvāshādha-nakshatra …*" (Rice, 1974: 126–127), but it turns out that this solar eclipse was actually in the month of *Āsvina*, on 30 September 1521 CE. It was annular and the greatest eclipse happened over Peru at 16:19 UT.

   Similarly, there is an inscription on a stone near a tank at Tumbinakere named as "Śringéri Jágir 15" (Rice, 1901: 199), dating to the year Śaka 1442. It is about the sale of the agrahāra rice-land together with a tank to the people of a place called Kigga, near Śringéri in Chickmagalur District. The inscribed date, "svasti sri jayàbhyudaya-Śaka-varsha 1442 ne ..... Vikrama-samvatsarada Phálguna-ba-amà .. e .. .... kàluyali Śringériya sri-mathada Vidya …", is not fully readable but is sufficient to suggest that it is the last day of the month *Phálguna* (*amànta*) and also the year, which is equivalent to 8 March 1521. This is actually a month prior to the solar eclipse of 7 April 1521, which Shylaja and Ganesha (2016: 114) associated with the Tumbinakere grant. By the way, this eclipse was visible over Sringeri (13.419° N, 75.256° E), reaching a magnitude of 0.87.

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