

Updated proposal to encode Tulu-Tigalari script in Unicode

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Document History & Background Documents :

(This document replaces L2/17-378)

L2/11-120R Preliminary proposal for encoding the Tulu script in the SMP of the UCS
– Michael Everson

L2/16-241 Preliminary proposal to encode Tigalari script
– Vaishnavi Murthy K Y

L2/16-342 Recommendations to UTC #149 November 2016 on Script Proposals
– Deborah Anderson, Ken Whistler, Roozbeh Pournader,
Andrew Glass and Laurentiu Iancu

L2/17-182 Comments on encoding the Tigalari script
– Srinidhi and Sridatta

L2/18-175 Replies to Script Ad Hoc Recommendations (L2/16-342) and Comments (L2/17-182)
on Tigalari proposal (L2/16-241)
– Vaishnavi Murthy K Y

L2/17-378 Preliminary proposal to encode Tigalari script
– Vaishnavi Murthy K Y, Vinodh Rajan

L2/17-411 Letter in support of preliminary proposal to encode Tigalari
– Guru Prasad (*Has withdrawn support. This letter needs to be disregarded.*)

L2/17-422 Letter to Vaishnavi Murthy in support of Tigalari encoding proposal
– A. V. Nagasampige

L2/18-039 Recommendations to UTC #154 January 2018 on Script Proposals
– Deborah Anderson, Ken Whistler, Roozbeh Pournader, Lisa Moore, Liang Hai,
and Richard Cook

A note on recent updates :

—**Tigalari Script is renamed Tulu-Tigalari script.** The reason for the same is discussed under section 1.1 (pp. 4-5) of this paper & elaborately in the supplementary paper Tulu Language and Tulu-Tigalari script (pp. 5-13).

—This proposal attempts to harmonize the use of the **Tulu-Tigalari script for Tulu, Sanskrit and Kannada languages for archival use.** It also provides for the contemporary Tulu usage without distorting the traditional orthography.

—The following characters are added to the proposed Tulu-Tigalari Unicode block :

- ◌̣ Virama : Is not a control character. Behaves as independent Virama.
- ◌̣ Joiner : Is introduced to create conjuncts.
- ◌̣ Looped Virama : Is used to create the alternate Looped Virama ligature.
- ◌̣ Repha : Is an independent mark.

—The Virama Sign is to be recognised as a vowel modifier diacritic to represent Tulu special vowels when added to V./V.S. A, AA, E & EE.

- ಞ್ Vowel ಁ
- ಞ̣ Vowel Sign ಁ
- ಞ್ಞ Vowel ಁ:
- ಞ್ಞ̣ Vowel Sign ಁ:
- ಞ್ಞ̣ Vowel ಁ:
- ಞ್ಞ̣ Vowel Sign ಁ:

The symbols used to represent these five vowels in this paper are listed below :

Kannad	Tu.Lex.	Description	IPA (/approx./)	Rep.Symbol Used
ಅ	ʌ	(Close to close-mid) (central to back) unrounded short vowel	: / ʌ - ɪ - u /	ʌ
ಅಃ	ʌʌ	(Close to close-mid) (central to back) unrounded long vowel	: / ʌ - ɪ - u : /	ʌ:
ಎ	e	Close-mid front unrounded vowel	: e	E
ಎಃ	ɛ	(Open-mid to Near-open) front unrounded short vowel	: / ɛ - æ /	ɛ
ಎಃಃ	ɛɛ	(Open-mid to Near-open) front unrounded long vowel	: / ɛ - æ : /	ɛ:

KEY : **V.S.** Vowel Sign
V/V.S. Vowel / Vowel Sign
L.Vir Ligating Virama
 (to the left of a character) ← ○ → (to the right of a character)

1 Introduction

This proposal attempts to present a coherent orthography for the archaic Tulu-Tigalari script as seen used predominantly in hand-written manuscripts. Additionally, it records the recently added characters that are being used to support the Tulu language. All the recommendations made in this proposal are the author's view alone. Srinidhi A and Sridatta A have generously shared their original research into Tulu-Tigalari script orthography with the authors. Their work and feedback is integrated into this paper.

The Tulu-Tigalari¹ script is commonly found in several manuscripts found all along the western coastal belts and the Sahyadri mountain ranges (*Malanad*) of Karnataka and the northern districts of Kerala. Since Tulu-Tigalari was never used in a printed format, it gradually fell into disuse and was forgotten as a secret script (*Gupta lipi*). The large number of manuscripts available in this script have been found to be of great value due to the variety and complexity of topics covered by them.² A vast majority of these manuscripts are being restored, catalogued, digitised and studied today by several institutions.³ The research community would therefore find it useful to have a Unicode supported Tulu-Tigalari typeface.

On another front, there is a renewed interest in the Tulu-Tigalari script among the Tulu speaking community as this script was previously used in the Tulu speaking regions. Tulu language requires a few additional characters in Tulu-Tigalari to support it fully (Refer to the supplementary paper 'Tulu Language and Tulu-Tigalari script' for details). It would therefore be very useful to support Tulu-Tigalari as there is ready use for this script.

Tulu-Tigalari was used in print and therefore not formally standardized. The glyphs referred to here are based on: hand written samples found largely on palm leaf/paper manuscripts, stone/metal inscriptions and the works of several scholars who have studied this script closely (Refer Figures 1-4). It has to be noted here that the Tulu-Tigalari script in most of these samples are surprisingly similar in their orthography and letter construction considering there was no formal standard that was followed. The samples studied are largely from libraries and private collections found across the states of Karnataka, Tamil Nadu and Kerala. A handful of users who still practice this script were also contacted.

1 Tigalāri

2 There are over 5,000 manuscripts in the Udupi Ashta Muthas alone. Over 500 manuscripts at Dharmasthala and 4000 manuscripts recorded in the Descriptive Catalogue of Tigalari Palm Leaf Manuscripts compiled Keladi Gunda Jois and S.R. Rao. There would be several thousands more if you take into account manuscripts found in smaller temples and homes of people of this region along with many manuscripts found in libraries and archives across India.

3 Several manuscripts are being restored, digitized and read in places like Udupi Mutts (Udupi, Mangalore, Sirsi etc.), Dharmasthala Trust (Mangalore), Tara Prakashana (Bangalore), French Institute of Pondicherry (Puducherry), Poornaprajna Samshodhana Mandiram (Bangalore), Keladi Museum (Sagara), Govind Pai Research Institute (Udupi) to name a few. A few digitised manuscripts from FIP are available online : <http://www.ifpindia.org/manuscripts/>

1.1 Script Name

The script being proposed here is was referred to by several names. The four commonly used ones are listed below (Refer to the supplementary paper 'Tulu Language and Tulu-Tigalari script' for a detailed analysis of this topic) :

NAME OF THE SCRIPT	PREVALENT IN	REFERENCES TO THEIR ROOTS
Western Grantha / Tulu-Malayalam ⁴	A few academic publications	19 th Century Western scholars.
Tulu Lipi / Taulava Lipi Tulu Grantha Lipi	Coastal Karnataka	Tulu speakers, eminent scholars like Dr. P Venkataraj Punichittaya & A C Burnell, Tulu Sahitya Academy.
Tigalari / Tigalarya	Tulunadu & <i>Malenadu</i> ⁵ (hilly regions of Karnataka)	Kannada speakers. Havyaka Community of both <i>Tulunadu</i> and <i>Malenadu</i> , National Manuscript Mission Catalogues : popularised by Keladi Gunda Jois. Recoded by Dr P Venkataraj Punichittaya as an alias in his books.
Grantha Lipi	Udupi Ashta Matha	Used for Hindu religious purposes and learning.

The name by which this script is referred to is closely tied to its regional, linguistic or historical roots. It would not be wrong to assign all the names mentioned above to this script. Considering the technical difficulties in doing so, discussed below are a few reasons for choosing the term 'Tulu-Tigalari' in the current context.

It is to be noted here that *Arya Ezhuttu* or what is commonly referred to as 'Grantha Malayalam' or sometimes the 'Tulu-Malayalam script', is a sister script of the Tulu-Tigalari Script that is being discussed here. It is the predecessor to the current reformed Malayalam script. Grantha Malayalam has a few peculiarities that diverge from Tigalari like CHILLU LLL, LETTER TTTA and *Samvrutokaram* behaviour, to name a few. The character shapes of Grantha Malayalam differ slightly from Tigalari when seen closely.

'Tulu script' or 'Taulava Grantha script' is the term used to refer to this script in the coastal regions of Karnataka and the Kasaragod district of Kerala. It is also called the 'Tulu script' in the seminal book documenting the various South Indian scripts, 'Elements of South Indian Palaeography' by Rev. A C Burnell. He also calls this the 'Western Grantha Script' in the same book. Dr. Venkataraja Puninchathaya has also published a book called Tulu lipi (*Lipi* meaning script) where he mentions Tulu-Malayalam, Tigalari and Tulu scripts as being sister scripts. There are several recent publications and instructional books for learning this script in the Tulu regions that use the term 'Tulu Script'.

⁴ Rev. A C Burnell refers to this script as Tulu-Malayalam script and calls it a form of western Grantha script. The Grantha script used in the Tamil region is in the same sentence called the Eastern Grantha script. (page 41.)

⁵ Also called Malanadu and Malnad

The term ‘Tigalari’ is used to this day by the Havyaka brahmins of the *Malenadu* and *Tulunadu* regions. ‘Tigalari’ is also commonly used to refer to this script in several manuscript catalogues and in academic publications today. Prof. Keladi Gunda Jois popularised ‘Tigalari’ to refer to this script across India. He published his findings that were based on evidences found in stone inscriptions (Refer Figure 5), palm leaf manuscripts and early research work done by scholars like Prof. B L Rice. He finds the name used for this script historically in Karnataka as being ‘Tigalari’. The stone inscription referred to by Prof. Gunda Jois where the term ‘Tigalari’ is mentioned however seems to refer to the Tamil Grantha script that was being used at the time in the Mysore region where the inscription was found. However, there are various instances where scholars like Gunda Jois, Punichataya and Vighnaraj have documented ‘Tigalari’ as being the term used to refer to this script by the Havyaka Brahmins of *Tulunadu* and *Malenadu*.

There are several scholars who are of the opinion that the Tulu script and Tigalari are two different scripts. This is however untrue. These scripts are found to be identical in every way by the authors. The minor variations in the various scribal hands is homogeneous to both the *Tulunadu* and *Malenadu* regions. There is no specific regional differences when it comes to shapes or script behaviour that stands out.

The question arises whether ‘Tulu’ or ‘Tigalari’ should be chosen to name this script. Adopting a hybrid naming scheme such as ‘Tulu-Tigalari’ for all practical purposes of this script encoding is therefore proposed by the authors. The alternate ‘Taulava Grantha’ can be added as an alias similar to the alternate names added to Siddham and Tai Tham scripts.

1.2 Geography

Tulu-Tigalari was used along the western coastal regions of South India (from Goa to Kasaragod) and the surrounding mountain ranges of the western ghats (Sahyadri). These regions would mainly comprise *Uttara Kannada*, Udupi, Mangalore and Shimoga districts of Karnataka and Kasaragod district in Kerala.

1.3 Languages

Tulu-Tigalari was used to write Sanskrit, Tulu and Kannada languages. It was used mostly by the Shivalli (Tulu/Kannada speaking), Havyaka (Kannada speaking) and Kota (Kannada speaking) brahmins to write Sanskrit religious texts. We also find a few examples of Tulu-Tigalari manuscripts containing original pieces of Tulu (Refer Figures 12, 14) and Kannada literature (Refer Figures 8.1, 8.2, 10).⁶ The orthography of Tulu-Tigalari is influenced by other dominant languages/scripts like Nandinagari, Kannada, Tamil Grantha and Malayalam (Refer to the script comparison cart : Figure 6). We find several predominantly Tulu-Tigalari manuscripts that use multiple scripts (Refer Figures 8.2, 8.3). The commonly found scripts in such manuscripts are Kannada and Nandinagari.

6 Tulu books : Kaveri, Ramayana, Bhagavato, Mahabharato, Devi Mahatmyam
Kannada Books : Vamanajayanti anantavratam, Gramapaddhati, Yajnavalkya vyavaharadhiyaya, Surya-chandra grahan-adhyaya, Gokarna Mahatmyam (Note : Keladi Museum: Descriptive catalogue of Tigalari manuscripts records several Tigalari script, Kannada language books. On inspection of a couple of these manuscripts, they appeared to contain Kannada script along with Tulu-Tigalari and not Kannada language (the language was Sanskrit). Awaiting scans for the manuscripts listed here currently not available in the Museum.)

2 History of Tulu-Tigalari Script

There is a lack of material/research available for accurately dating the introduction of this script to these regions and the reasons for doing so when there were several other scripts that were actively used here at the time to write Sanskrit.

In a few of the older manuscript examples found so far, we come across the notable philosopher and god man Madhwacharya's student Hrishiksha Teertha recording Madhwa's teachings using this script. These manuscripts are called *Sarvamoola Grantha* or the root books.⁷ From this, based on the time-period that Madhwacharya might have been alive, we can comfortably come to the conclusion that Tulu script was being actively used in this region from at least 1300 CE.

It is commonly stated by those who have studied this script that due to geographic isolation of this region created by the western ghats to the east and the Arabian sea to its west, Tulu-Tigalari further evolved independently from the Chola Grantha Script.⁸ Besides this, if you take into account several prominent character constructions it retains from the Chola Grantha script and the fact that it was a fully formed script when it was used in *Sarvamoola Grantha*, it seems possible that Tulu-Tigalari might have existed at-least a century before Madhwa.⁹

The regions where Tulu-Tigalari was used have been centres of learning for centuries and still continues to have high levels of literacy. It naturally follows that the manuscripts written in these regions; majority of which are in Tulu-Tigalari script; to be of great literary and scientific value. These manuscripts cover a wide range of subjects such as: medicine, various sciences, Vedas, Sutras, Upanishads, mathematical formulae, daily accounts, astronomy, aesthetics and philosophy to name a few.

Historically, the rulers of these regions were subordinates of the larger Kannada kingdoms. They used Kannada script for official purposes. It's probably because of this along with economic reasons that the Basel Missionaries, who were aware of its use and having studied this script closely, thought it best to use Kannada script over Tulu-Tigalari.

7 <http://www.sciencedaily.com/releases/2006/09/060919102046.htm>

8 Rev. Burnell (EOSIP Pg. 41, 42) ascribes this script to about 8th or 9th Centuries AD and goes on to analyse the characteristic features this script and compares it with the Chola Grantha script.

9 Several stone inscriptions found in Udupi Taluk and Kadargod are currently being examined and are tentatively dated to mid 12th century based on the name references.

3 Current Situation

Tuḷu Sahitya academy, a cultural wing of the Government of Karnataka, has introduced Tuḷu language study materials. Tulu language is being taught in schools across the Mangalore and Udupi districts. The text books for Tulu are currently in Kannada script. They are however trying to re-introduce Tulu-Tigalari (called Tulu script in these regions) by providing instructional manuals to learn this script (Refer Figure 45) (Refer Appendix 1 for a brief analysis on the Reformed Tulu-Tigalari script invented by the Tulu Sahitya Academy). A few workshops¹⁰ conducted by them in the previous years to teach Tulu-Tigalari were well attended. They have also published ‘Tuḷu script’ lessons on their website to popularise it.¹¹ Due to this increased interest in Tulu-Tigalari, there is a pressing need to have a Unicode compliant Typeface that will enable its use both in print and web.

In the *Tulu speaking regions*, Tulu-Tigalari is in continuous use for several ritual purposes like writing birth charts, creating charms and *Mandalas* (during *Yajña*) or for reciting/memorising religious scriptures (*Pārāyaṇa*) from manuscripts that have been handed down generations. Making new copies of the ancestral manuscripts is considered meritorious and several copies of the same manuscript are commonly found. The religious heads of the eight Mutts (*Ashta matha*) of Udupi (established over 800 years ago) have been traditionally forbidden to use any script apart from Tulu-Tigalari. Due to this, we see their signatures in this script to this day (Refer Figure 9). We also find large collections of Tulu-Tigalari manuscripts in these Mutts and the students are taught this script by following the lines in the manuscript as the teacher recites. Over time, one begins recognise the characters for the sounds they stand for. Apart from this, there are several religious and government bodies who have undertaken large-scale conservation and digitisation of the Tulu-Tigalari manuscripts. A working typeface for Tulu-Tigalari is an immediate requirement for archival, research and documentation purposes.

4 Proposal History

This proposal is a revision of the draft proposal titled “Preliminary proposal for encoding the Tuḷu script in the SMP of the UCS”, submitted on 2011-04-22 by Michael Everson. Since this is an attempt at standardizing Tulu-Tigalari for the first time in a formal manner, the characters cited there have been re-visited and at times revised after careful examination of primary sources. The glyph forms presented here are the normalized/standardized version of the script based on research into various sources.

¹⁰ Tuḷu Script workshops are also held at Poornaprajna Vidyapeetha, Bangalore, which is affiliated to Karnataka Sanskrit University. Poornaprajna Vidyapeetha and Udupi Mutts house several scholars in Sanskrit and Tuḷu languages who also know Tulu-Tigalari. Many of the old Tulu-Tigalari manuscripts are serving as materials of study for Ph.D. students.

¹¹ <http://www.tuluacademy.org/en/category/tulu-alphabets/> There are several errors in representing Tulu-Tigalari in this primer and therefore cannot be used as a reference.

A Tulu-Tigalari font was released by the Tulu Sahitya Academy under the name 'Tulu script Unicode Version' on 15 September 2014. This font built on Malayalam code-points. This font, despite being an interesting experiment, does not function properly to support Tulu-Tigalari for academic use. It does not take advance of the advances in type technology available today that enables better representation of alternate forms and complex character constructions. Also, the font reflects a lot of contemporary Malayalam script influences in its typographic interpretation.

5 Structure

Tulu-Tigalari is an alpha syllabic script belonging to the Brahmic family where each letter carries an inherent schwa vowel. This vowel is commonly referred to as the vowel 'A' or [ə] in the IPA. Its orthography is similar to Grantha¹² and Malayalam scripts (Refer Figure 6)¹³. Today, majority of the Tulu-Tigalari script users are well versed in Kannada/Malayalam and Devanagari scripts. Because of this, the switch will be mostly between these scripts and Tigalari. (Refer to the supplementary paper 'Tulu language and the Tulu-Tigalari script'.)

Total number of proposed characters : 80

5.1 Vowels (*Swarakshara*)

Tulu-Tigalari has 16 independent vowels or *Swarakshara* which includes 2 diphthongs (TULU-TIGALARI LETTER AI & TULU-TIGALARI LETTER AU) along with *Anuswara* and *Visarga*. Keeping with the structure of Indic proposals, *Anuswara* and *Visarga* are discussed under Section 8.1.

The Tulu-Tigalari vowels are to be encoded atomically in Unicode even if they can be analysed visually as consisting of multiple parts. This behaviour is similar to the vowel letter behaviour in Malayalam¹⁴. For example, Tulu-Tigalari Letter AI (᳚᳚᳚) does not decompose as Tulu-Tigalari Vowel Sign EE (᳚᳚᳚) + Tulu-Tigalari Letter EE (᳚᳚᳚). Instead, Tulu-Tigalari Letter AI (᳚᳚᳚) will have a separate unique Unicode value.

USE	✓	DO NOT USE	✗
11383	᳚᳚᳚	< 11382 + 113C9 >	᳚᳚᳚ + ᳚᳚᳚
11385 (alt. form)	᳚᳚᳚	< 11384 + 113C9 >	᳚᳚᳚ + ᳚᳚᳚
1138E	᳚᳚᳚	< 113C2 + 1138B >	᳚᳚᳚ + ᳚᳚᳚
11391	᳚᳚᳚	< 11390 + 113C9 >	᳚᳚᳚ + ᳚᳚᳚

It needs to be noted here that many scholars of the Tulu speaking region recognise special vowels : ᳚᳚᳚ (᳚᳚᳚), ᳚᳚᳚ (᳚᳚᳚), ᳚᳚᳚ (᳚᳚᳚) and ᳚᳚᳚ (᳚᳚᳚) as *Swarakshara* (discussed under Section 5.4) (Refer to the supplementary paper 'Tulu language and Tulu-Tigalari Script').

¹² Throughout this document, 'Grantha', when used alone, refers to the modern Grantha script (U+11300–U+1137F).

¹³ Despite Tulu-Tigalari being visually similar to Malayalam, its behaviour and combining mark properties are closer to Grantha. It is therefore advisable to not correlate the character properties between Malayalam and Tulu-Tigalari to a large extent. Especially when it comes to *Chillu* behaviour.

¹⁴ Refer to Table 12-30 for Malayalam in The Unicode Standard 9.0 (TUS).

TULU-TIGALARI LETTER A (a)	ᳵ᳚
TULU-TIGALARI LETTER AA (ā)	ᳵ᳛
TULU-TIGALARI LETTER I (i)	ᳵ᳜
TULU-TIGALARI LETTER II (ī)	ᳵ᳝
TULU-TIGALARI LETTER U (u)	ᳵ᳞
TULU-TIGALARI LETTER UU (ū)	ᳵ᳟
TULU-TIGALARI LETTER VOCALIC R (ṛ)	ᳵ᳠
TULU-TIGALARI LETTER EE (ē)	ᳵ᳡
TULU-TIGALARI LETTER AI (ai)	ᳵ᳢
TULU-TIGALARI LETTER OO (ō)	ᳵ᳣
TULU-TIGALARI LETTER AU (au)	ᳵ᳤

TULU-TIGALARI LETTER VOCALIC RR (Ṛ) & TULU-TIGALARI LETTER VOCALIC L (Ḍ) are rare and are mostly found in the Sanskrit language *Shakta* texts as *Bijakshara*. The long syllabic lateral: TULU-TIGALARI LETTER VOCALIC LL (ḹ) is found only nominally in the alphabet¹⁵. These sounds are common to Tulu but is not recorded in the written language.

TULU-TIGALARI LETTER VOCALIC RR (Ṛ)	ᳵ᳠
TULU-TIGALARI LETTER VOCALIC L (Ḍ)	ᳵ᳡
TULU-TIGALARI LETTER VOCALIC LL (ḹ)	ᳵ᳢

TULU-TIGALARI LETTER O & TULU-TIGALARI LETTER E and their equivalent vowel signs are not present in the traditional Tulu-Tigalari orthography and therefore not included in this proposal. However, these two characters are essential for writing Tulu and Kannada languages. We see some initial attempts to introduce these characters for Tulu-Tigalari in Tulu language manuscripts (discussed in detail in the attached supplementary paper : Tulu Language and Tulu-Tigalari Script). It will be useful to have these characters and their equivalent vowel signs encoded for the Tulu audience who are already using this script as a part of the language and script revival exercise in schools and public gatherings. (Refer Figures 42, 43, 44.1. Refer to the supplementary paper 'Tulu Language and Tulu-Tigalari script' for a detailed analysis of this topic).

15 The debate on whether or not to add vocalic LL character to the Sanskrit alphabet has been going on since the time of Panini. It is he who supposedly introduced this character. Prominent Sanskrit grammarians like Apishali have questioned the existence of this. Despite this millennia old debate, vocalic LL needs to be encoded as this character exists in the Tulu-Tigalari manuscripts. (Ref : Emeneau, M. B. "The Nasal Phonemes of Sanskrit." *Language*, vol. 22, no. 2, 1946, pp. 86. JSTOR, www.jstor.org/stable/410341.)

5.2 Dependent Vowel Signs

All independent *Swarakshara* have their corresponding dependent vowel signs except for TULU-TIGALARI LETTER A (inherent). These signs combine before, after, above and below other consonants/conjuncts, replacing the final inherent vowel 'A'. TULU-TIGALARI VOWEL SIGN AA is seen combining with other independent vowels in a few manuscripts to indicate the elongation of the shorter vowels¹⁶. This behaviour of 'AA' as a vowel lengthening sign should be supported by rendering engines. The vowel signs' decomposition is similar to their Malayalam counterparts.

(a.) Right spacing vowel signs :

Vowel signs AA, I & II are placed to the right of a character/conjunct.

TULU-TIGALARI VOWEL SIGN AA (ā) ೀ

കി = ക + ೀ
|KA.A |KA |A-v.s.

Behavior ക > ണ :

കി ഖി ഗി ണി ണി ചി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി
ഘി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി
ര ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി

TULU-TIGALARI VOWEL SIGN I (i) ೆ

കി = ക + ೆ
|KI |KA |I-v.s.

Behavior ക > ണ :

കി ഖി ഗി ണി ണി ചി ണി ണി ണി ണി ണി ണി ണി ണി ണി
ഘി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി
ര ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി ണി

¹⁶ This behaviour is seen in old Kannada manuscripts as-well. For example :
U (ಉ) + AA vowel mark (ಃ) = UU (ಉಃ)

TULU-TIGALARI VOWEL SIGN II (ī) ീ

കീ = ക + ീ
|KII |KA |II-v.s.

Behavior ക > ണ :

കീ ചീ ഗീ ളീ ക്കീ ചീ ഴീ ഴീ ക്കീ ഴീ ഴീ ഴീ ഴീ
 ഴീ ക്കീ ക്കീ ക്കീ ക്കീ ക്കീ ക്കീ ക്കീ ക്കീ ക്കീ ക്കീ
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(b.) Vowel signs re-ordered to the left of the base character :

Tulu-Tigalari vowel signs EE & AI re-order; appearing before a character/conjunct.

TULU-TIGALARI VOWEL SIGN EE (ē) ീ

കേ = ക + ീ
|KEE |KA |EE-v.s.

Behavior ക > ണ :

കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ
 കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ
 കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ
 കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ കേ

TULU-TIGALARI VOWEL SIGN AI (ai) ീ

കൈ = ക + ീ
|KAI |KA |AI-v.s.

TULU-TIGALARI AI LENGTH MARK (ീ) U+ 113C8 should be used.

ീ IS NOT ീ + ീ
|AI-v.s. ≠ |EE-v.s. |EE-v.s.

Behavior $\text{ක} \triangleright \text{റ} :$

കറ കറച കറഗ കറയ കറൺ കറച കറശ കറൺ കറ
 കറ റ കറ കററ കററ കററ കററ കററ കററ കററ
 കററ കററ കററ കററ കററ കററ കററ കററ കററ
 കററ കററ കററ കററ കററ കററ കററ കററ

(c.) Two part vowel signs :

Vowel signs OO & AU are two part vowel signs that appear both before and after a character/ conjunct and would also require re-ordering. The behaviour of Tulu-Tigalari two part vowels are similar to Malayalam two part vowels with an exception of TULU-TIGALARI VOWEL SIGN AU.

TULU-TIGALARI AU LENGTH MARK (ൺ) is encoded separately similar to TAMIL AU LENGTH MARK U+0BD7. It is to be noted here that unlike MALAYALAM AU LENGTH MARK U+0D57, in Tulu-Tigalari, this mark is not to be used in isolation. ൺ mark is used primarily to render the two part TULU-TIGALARI VOWEL SIGN EE. TULU-TIGALARI VOWEL SIGN O is a recent introduction. The representative glyph seen here is recommended by the author. It is based on the structure and behaviour of Tulu-Tigalari script.

The normalised form of two part vowels require for a equivalent combination of two component vowel sign code points to render them accurately. To avoid confusion, a single code point which appears after the base consonant should be assigned to this combination of code points that form a single two part vowel sign. The equivalence decomposition information for the rendering engines is as follows :

TULU-TIGALARI VOWEL SIGN OO (õ) കറ

കറ = ക + കറ
 |K00 |KA |00-v.s.




കറ ≡ കറ + റ
 |00-v.s. |EE-v.s. |A-v.s.



Behavior $\text{ക} \triangleright \text{റ} :$





































കറ കറച കറഗ കറയ കറൺ കറച കറശ കറൺ കറ
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TULU-TIGALARI VOWEL SIGN AU (au) 

 =  + 
 |KAU |KA |AU-v.s.

 ≡  + 
 |AU-v.s. |EE-v.s. |AU-length mark

Behavior  ►  :

(d.) Vowel signs placed below & ligating to the right :

Tulu-Tigalari vowel signs U, UU, vocalic R & vocalic RR are rendered as ligatures. TULU-TIGALARI VOWEL SIGN U & TULU-TIGALARI VOWEL SIGN UU change their shape depending on the consonant they combine with (Refer Figures 11, 37, 38. Refer to the supplementary paper 'A list of common Tigalari conjuncts'.)¹⁷.




TULU-TIGALARI VOWEL SIGN U (u)    

(Default representation form : )

 =  + 
 |PU |PA |U-v.s.

 =  + 
 |CHU |CHA |U-v.s.

 =  + 
 |KU |KA |U-v.s.

 =  + 
 |KU |KA |U-v.s.(alternate form)

¹⁷ For more information on this behaviour, refer : Comments on encoding the Tigalari script - Srinidhi A & Sridatta A - L2/17-182, 2.1 Contextual vowel signs of U and UU, Page 7. (<http://www.unicode.org/L2/L2017/17182-tigalari-cmt.pdf>)

Behavior **ക** ▶ **ന** (Common forms in Blue + Alternate forms) :

ക ക // ച // ഗ // ധ // ണ // ച // ഷ ഷ
 ഷ ഷ // ഞ // ള ള // റ // ള // ള
 ണ ണ // ക // ധ // ള // ള // ള
 പ // ധ // പ // ധ // ധ // ധ // ധ
 ധ // ധ // ധ // ധ // ധ // ധ // ധ

TULU-TIGALARI VOWEL SIGN UU (ū) ൓ ൒ (Default form : ൓)

കു = ക + ൓
 |CHUU |CHA |UU-v.s.

കു = ക + ൓
 |KHUU |KHA |UU-vs

Behavior **ക** ▶ **ന** (Common forms in Blue + Alternate forms) :

ക // ച // ഗ // ധ // ണ // ച // ഷ ഷ // ഷ // ഷ // ഷ
 ഷ // ഷ // ഷ // ഷ // ഷ // ഷ // ഷ
 ഷ // ഷ // ഷ // ഷ // ഷ // ഷ // ഷ
 ഷ // ഷ // ഷ // ഷ // ഷ // ഷ // ഷ




TULU-TIGALARI VOWEL SIGN VOCALIC R (r) റ



കു = ക + റ
 |KRU |KA |Vocalic RR-v.s.





























































Behavior **ക** ▶ **ന** :

ക ച ഗ ധ ണ ച ഷ ഷ ഷ
 ഷ ഷ ഷ ഷ ഷ ഷ ഷ
 ഷ ഷ ഷ ഷ ഷ ഷ ഷ

TULU-TIGALARI VOWEL SIGN VOCALIC RR (ṛ) ೠ


 =
 
 +
 
 |KRUU |KA |Vocalic RR-v.s.

Behavior  ►  :

(e.) Placed below [or] placed below & ligating to the right :




We find this behaviour in Vowel Signs for Vocalic L & Vocalic LL. Both these vowels and extremely rare to come-by in manuscripts.



The Vowel sign for Vocalic L has two varying forms¹⁸. The first form is most commonly seen in manuscripts. The second form is recorded by Dr. Venkataraja Puninchathaya in a booklet called Tulu Lipi, 2001.

- 1.) Placed directly below (ೠ) (*This is the most commonly used form of Tulu-Tigalari manuscripts*)
- 2.) Below + right ligating (ೠ)¹⁹

Further illustrating their behaviour :

TULU-TIGALARI VOWEL SIGN VOCALIC L (ḷ) ೠ


 =
 
 +
 
 |KLU |KA |Vocalic L-v.s.

Behavior  ►  :






























































¹⁸ A third option exists where the vocalic L and vocalic LL marks are placed placed above the base and to the right (കര & കര). This behaviour is seen in only one manuscript so-far and therefore not included here.

¹⁹ This form of Vowel Sign Vocalic LL is seen recorded by : Burnell, A. C. "Elements Of South-Indian Palaeography." Elements of South-Indian Palaeography from the Fourth to the Seventeenth Century A.D., 1878, Plate XVI.

TULU-TIGALARI VOWEL SIGN VOCALIC L (ಲ) ಲ್ಲ




 =  + 
 |KLU |KA |Vocalic L-v.s. (alternate form)

Behavior ಡಿ ► ಣ :

ಡ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ
 ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ
 ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ ಲ್ಲ

Vocalic LL vowel mark is added directly below the consonant it is combining with.

TULU-TIGALARI VOWEL SIGN VOCALIC LL (ಲಿ) ಲ್ಲಿ

 =  + 
 |KLUU |KA |Vocalic LL-v.s.

Behavior ಡಿ ► ಣ :

ಡ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ
 ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ
 ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ ಲ್ಲಿ

5.3 Consonants & Semi-vowels (Vyanjanakshara)

Consonants and semi-vowles together constitute *Vyanjanakshara*. Consonants in Tulu-Tigalari script orthography are traditionally laid-out in a phonetic order similar to other Indic scripts.

Consonants (25)	Un-aspirated	Aspirated	Nasals
Guttural	KA, GA	KHA, GHA	NGA
Palatal	CA, JA	CHA, JHA	NYA
Retroflex	TTA, DDA	TTHA, DDHA	NNA
Dental	TA, DA	THA, DHA	NA
Labial	PA, BA	PHA, BHA	MA
Semi-vowels (11)	YA, RA, RRA, LA, VA, SHA, SSA, SA, HA, LLA, LLLA		

All *Vyanjanakshara* have an equivalent post-base form called *Adi vottu*²⁰. The behaviour of *Adi vottu* is further discussed under Section 5.5

	CONSONANTS	POST-BASE / BELOW-BASE FORMS
TULU-TIGALARI LETTER KA (ka)	ක	ක ක
TULU-TIGALARI LETTER KHA (kha)	ච	ච ච
TULU-TIGALARI LETTER GA (ga)	ග	ග ග
TULU-TIGALARI LETTER GHA (gha)	ඟ	ඟ ඟ
TULU-TIGALARI LETTER NGA (ṅa)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER CA (ca)	ච	ච ච
TULU-TIGALARI LETTER CHA (cha)	ච	ච ච
TULU-TIGALARI LETTER JA (ja)	ඟ	ඟ ඟ
TULU-TIGALARI LETTER JHA (jha)	ච	ච ච
TULU-TIGALARI LETTER NYA (ṇa)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER TTA (ṭa)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER TTHA (ṭha)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER DDA (ḍa)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER DDHA (ḍha)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER NNA (ṇa)	ඟ්	ඟ් ඟ්
TULU-TIGALARI LETTER TA (ta)	ත	ත ත
TULU-TIGALARI LETTER THA (tha)	ඳ	ඳ ඳ
TULU-TIGALARI LETTER DA (da)	ද	ද ද
TULU-TIGALARI LETTER DHA (dha)	ඳ	ඳ ඳ
TULU-TIGALARI LETTER NA (na)	න	න න
TULU-TIGALARI LETTER PA (pa)	ථ	ථ ථ
TULU-TIGALARI LETTER PHA (pha)	ඳ	ඳ ඳ
TULU-TIGALARI LETTER BA (ba)	භ	භ භ
TULU-TIGALARI LETTER BHA (bha)	භ	භ භ
TULU-TIGALARI LETTER MA (ma)	ම	ම ම

	SEMI-VOWELS	POST-BASE / BELOW-BASE FORMS
TULU-TIGALARI LETTER YA (ya)	ೞ	ೞ
TULU-TIGALARI LETTER RA (ra)	ರ	ರ
TULU-TIGALARI LETTER LA (la)	ಲ	ಲ
TULU-TIGALARI LETTER VA (va)	ಁ	ಁ
TULU-TIGALARI LETTER SSA (śa)	ೞ	ೞ
TULU-TIGALARI LETTER SHA (ṣa)	ಱ	ಱ
TULU-TIGALARI LETTER SA (sa)	ಸ	ಸ
TULU-TIGALARI LETTER HA (ha)	ಹ	ಹ
TULU-TIGALARI LETTER LA (ḷa)	ಱ	ಱ

Tulu-Tigalari has two characters that represent the Dravidian sounds : LLLA (ḷa)) and RRA (ra, its called *Shakata Repha*). These two characters are rare and are mostly found in Kannada language manuscripts (Refer Figures 10). It is due to the discovery of these two borrowed Dravidian phonemes in Tulu-Tigalari manuscripts studied so far that a space for the TULU-TIGALARI LETTER NNNA is reserved.

TULU-TIGALARI LETTER LLLA (ḷa)	ಱ	ಱ
TULU-TIGALARI LETTER RRA (ṛa)	ಱ	ಱ

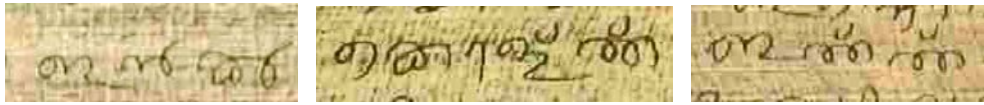
5.4 Virama

(Refer to the supplementary paper, 'Tulu language and Tulu-Tigalari Script' for Figures and examples for the Virama behaviour listed in this section.)

In ISCII based encoding models, the Virama character has been serving two purposes : to suppress the inherent Vowel A and as a control character to create conjuncts when placed next to a consonant/semi-vowel. In the Tulu-Tigalari script, Virama handling is complex. Virama's function as a control character is being re-looked at in this section to aid accurate shaping and indexing.

The special vowels ಌ, ಍, ಋ & ೠ appear frequently. The Tulu language, Tulu-Tigalari script manuscripts use the Virama character combined with the base V./V.S. A, AA & EE to represent these additional vowels discussed in the supplementary paper, 'Tulu Language and

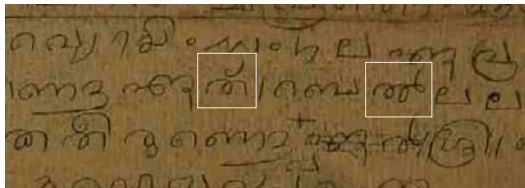
Tulu-Tigalari Script'. The Tulu language, Tulu-Tigalari script manuscripts often contain several successive characters with the Virama sign employed to represent these sounds. For example:



EXAMPLE 1: (LEFT) N ൽ, K ൽ, Tulu Word: INKṅ, ಇನ್ಕ್
 (CENTRE) LL ൽ, TT ൽ, Tulu Word: KOLLṅTTṅ, ಕೊಳ್ಳತ್ತ
 (RIGHT) TT ൽ, TT ൽ, Tulu Word: ITTṅTTṅ, ಇತ್ತತ್ತ
 (SOURCE) Tulu Ananta Vruta Kathe, Govinda Pai Research Centre, Udupi

A Virama also functioning as a control character when implemented for the Tulu language, would require extensive use of ZWNJ. Issues with shaping and indexing that arise from this can be avoided by having an independent Virama and adding a separated Joiner to create ligatures.

In addition to the two phonetic values, the Virama also forms a ligature with certain consonants and conjuncts. It is to be noted here that, there is no particular rule for the disjunct and conjunct Virama forms. Both the Virama forms appear with the same base consonant within a manuscript leaf. This behaviour is therefore not predictable.



EXAMPLE 2: The two Virama forms appearing within the same leaf. On the left the disjunct Virama is added to the base NA. On the right there is NA+NA+Virama ligature.
 (SOURCE) Tulu Ananta Vruta Kathe, Govinda Pai Research Centre, Udupi

There is however a repeated preference to form Virama ligatures with the characters listed below :

Consonants :

K ൽ G ൽ TT ൽ/ ൽ T ൽ N ൽ

Conjunct sequences :

K.K ൽ K.N ൽ K.T ൽ K.TT ൽ
 TT.TT ൽ
 T.T ൽ T.K ൽ T.N ൽ
 N.N ൽ N.T ൽ N.TT ൽ

The proposed solution would involve supporting the characters listed below for Virama handling in Tulu-Tigalari:

(a.) Virama - ು

The Virama character will be independently encoded. It will be used to represent the Vowel suppressant and the Tulu vowels ು, ು, ು & ು: (Refer Sections 5.1, 5.4).

(b.) Joiner - ು

A Joiner character will be used to create conjuncts.

(c.) Looped Virama - ು

A Looped Virama character will be used to create Virama ligatures with KA, TTA, TA & NA and other characters that may be attested in the future.

Illustrating their use :

(a.) **Virama (ು) :**

A Virama is used to suppress the inherent vowel A present in consonants/semi-vowels & to denote the Tulu language vowels ು, ು, ು & ು.

ക	=	ക	+	ഁ	+	ക
K(൐).KA		KA		Virama		KA

Sequence to break the KA & LA conjunct form (ക) and call the KA+Virama followed by LA+Virama :

ക	=	ക	+	ഁ	+	ല	+	ഁ
K(൐).L(൐)		KA		Virama		LA		Virama

The Virama combinations with V./V.S. A, AA, I, II, U, UU, EE and OO ²¹ needs to be supported to represent the special Tulu vowels. The Universal Shaping Engine (USE) currently treats Pure Killers as Vowels. Sequences involving Tulu Sign Virama should, therefore, be treated as valid. There shouldn't be any complications in rendering Tulu syllable sequences that use Tulu Sign Virama as a diacritic marker after Tulu Vowel Signs. Attested combinations are marked in **Blue** :

അ	ആ	ഇ	ഈ	ഉ	ഊ	ഈ	ഊ
ഁ	ഁ	ഁ	ഁ	ഁ	ഁ	ഁ	ഁ
A+Vir.	AA+Vir.	I+Vir.	II+Vir.	U+Vir.	UU+Vir.	EE+Vir.	OO+Vir.

²¹ The combinations with V./V.S. I, II & OO can be allowed for as there seems to be additional vowels not yet documented.

Virama Character Order :

Virama character always appears at the end of and to the top right of a cluster.

Consonant (𑌕) → Vowel Sign (𑌕) → Virama (𑌕) = 𑌕

(b.) Joiner (𑌕) :

The Joiner character is used to call ligature forms.

𑌕 = 𑌕 + 𑌕 + 𑌕
|K.KA |KA |Joiner |KA

𑌕 = 𑌕 + 𑌕 + 𑌕
|K.DA |KA |Joiner |DHA

Sequence to call the KA+LA ligature form ending with a Virama :

𑌕 = 𑌕 + 𑌕 + 𑌕 + 𑌕
|K.L(ə) |KA |Joiner |LA |Virama

(The '+' below the dotted circle (𑌕) representation as seen in other scripts is used for 'Tiddu' in Tulu-Tigalari. 𑌕 is used instead for Joiner glyph.)

In-order to override font-level conjoining defaults, a logic similar to what is suggested for Grantha is proposed here to call for either the horizontal or vertical conjunct forms.

Forced Vertical Conjunct : C1 + ZWJ + Joiner + C2 = <C1><C2>

𑌕 = 𑌕 + 𑌕 + 𑌕 + 𑌕
|K.KA |KA |ZWJ |Joiner |KA

Forced Horizontal Conjunct : C1 + Joiner + ZWJ + C2 = <C1><C2>

𑌕 = 𑌕 + 𑌕 + 𑌕 + 𑌕
|K.KA |KA |Joiner |ZWJ |KA

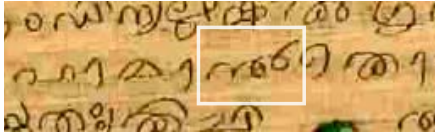
Introducing another Joiner is avoided here as doing this would create problems with searching and text input. One would have to rely on higher-level protocols to ensure both the joiners are treated in an equivalent manner. It appears to be optimal to use an existing default ignorable character to achieve the required joining behaviour. Ideally, it is recommended to achieve this not through control characters but by applying features such as stylistic sets at the font level.

(c.) **Looped Virama (ൽ) :**

The Looped Virama to call the Virama ligatures that form with KA ൞, GA ൢ, TTA ൣ/ ൤, TA ൤ & NA ൤. The Looped Virama is tightly bound to the preceding character and does not apply at a syllable level.

$$\begin{array}{c} \text{൞} \\ |K \end{array} = \begin{array}{c} \text{൞} \\ |KA \end{array} + \begin{array}{c} \text{ൽ} \\ |L.Vir \end{array}$$

Conjunct sequences that end with a Virama ligature are rare. Conjunct sequences that end with a Virama ligature : KK ൞൞, KN ൞൞, KT ൞൞, KTT ൞൞, TTTT ൞൞, TT ൞൞, TK ൞൞, TN ൞൞, NN ൞൞, NT ൞൞, NTT ൞൞. As this is not a predictable sequence at this stage of encoding, there is no need to restrict the behaviour of Looped Virama.

**EXAMPLE 3:** NT ൞൞

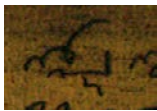
(SOURCE) Tulu Ananta Vruta Kathe, Govinda Pai Research Centre, Udupi

$$\begin{array}{c} \text{൞൞} \\ |K.K \end{array} = \begin{array}{c} \text{൞} \\ |KA \end{array} + \begin{array}{c} \text{⊕} \\ |Joiner \end{array} + \begin{array}{c} \text{൞} \\ |KA \end{array} + \begin{array}{c} \text{ൽ} \\ |L.Vir \end{array}$$

Sequence to form KA (+ Virama Ligature) & KA (+ Virama):

$$\begin{array}{c} \text{൞൞} \\ |K.K(ൿ) \end{array} = \begin{array}{c} \text{൞} \\ |KA \end{array} + \begin{array}{c} \text{ൽ} \\ |L.Vir \end{array} + \begin{array}{c} \text{൞} \\ |KA \end{array} + \begin{array}{c} \text{ൿ} \\ |Virama \end{array}$$

It is rare to find clusters with Vattu forms with a Looped Virama but we do find a few stray examples as shown below. It is not necessary at this stage to restrict the behaviour of the Looped Virama forms.

**EXAMPLE 4:** A rare example of a Looped Virama Conjunct + Vattu form. NA+PA+Virama

(SOURCE) Rigveda, Dodmane, Udupi

Sequence to form KA (+ Virama Ligature) & KA (Vattu):

$$\begin{array}{c} \text{൞൞} \\ |K.K \end{array} = \begin{array}{c} \text{൞} \\ |KA \end{array} + \begin{array}{c} \text{ൽ} \\ |L.Vir \end{array} + \begin{array}{c} \text{⊕} \\ |Joiner \end{array} + \begin{array}{c} \text{൞} \\ |KA \end{array}$$

The following are acceptable rendering for the sequences when the requested form is not attested or supported by the font. The incorrect rendering is to be clearly displayed :

 =
  +
  +
  +
 
 |K.K |KA |Joiner |KA |L.Vir

 =
  +
 
 |TH |THA |L.Vir

5.5 Ligatures :

A maximum of four consonant/semi-vowel characters can be found in Tagalari manuscripts that form a ligature. Similar to Grantha and old style Malayalam scripts, we find a large number of ligature forms across Tulu-Tigalari manuscripts (Submitted along with this document, as a separate paper, is a Conjuncts list commonly found in Tulu-Tigalari). One can assume that character clusters which were easy to write in a single continuous stroke without lifting the stylus/chisel ended-up as ligatures. There are a few Tulu-Tigalari ligatures that have varying behaviours across manuscripts as illustrated in an example below²². It is hard to come to a consensus and identify a definitive conjunct/ligature set or shape for this script as of now. The alternate forms of ligatures can be handled using the open-type feature—stylistic sets while making the font.

 =
  +
  +
  (Stylistic Set 1)
 |J.JA |JA |Joiner |JA

 =
  +
  +
  (Stylistic Set 2)
 |J.JA |JA |Joiner |JA

There are four basic types of ligatures in Tulu-Tigalari :

- [Consonant/Semi-Vowel] + [Consonant(s)/Semi-Vowel(s)] = Conjunct
- [Consonant / Conjunct/Semi-Vowel] + Vowel Sign
- [Consonant/Conjunct/Semi-Vowel] + Special Character
- Ligating Special Characters

(a.) [Consonant/Semi-Vowel] + [Consonant(s)/Semi-Vowel(s)] = Conjunct :

Consonants and semi-vowels in most cases have a corresponding post-base form that look similar to the independent consonant/semi-vowel that sits vertically centred below the base character (ೞ). These characters form vertical conjunct stacks with combining *vottu* forms. These post-base character(s) are represented at the same size as their corresponding base glyphs. These below-base forms are not reduced in size to save inter-linear space or to improve the over-all texture. This practice however might change over time as reflected in reformed Malayalam or Grantha typefaces. The conjunct forms can be defined at the font level. Stacking forms can be used where the ligature forms are not available.

Vertical stacking of conjunct forms is the default behaviour unless the font provides for an alternate rendering of a ligating form.

$$\begin{array}{c} \text{JH.NA} \\ \text{JH} \end{array} = \begin{array}{c} \text{JHA} \\ \text{JH} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{JH} \end{array} + \begin{array}{c} \text{NA} \\ \text{JH} \end{array}$$

Consonants/semi-vowels can combine horizontally, vertically or have a combination of both in Tagalari. Sometimes the same conjunct can have both these ways of ligating as seen above in the case of JJA. It is commonly found that the characters which have their final stem turning downwards and ending at the baseline form horizontal ligatures with characters that begin with upward strokes (K.TA). Characters which have their final stem turning downwards often combine horizontally with other character that begin with the downward stroke by loosing a stem in-between (NN.GA).

$$\begin{array}{c} \text{K.TA} \\ \text{K} \end{array} = \begin{array}{c} \text{KA} \\ \text{K} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{K} \end{array} + \begin{array}{c} \text{TA} \\ \text{K} \end{array}$$

$$\begin{array}{c} \text{NN.GA} \\ \text{NN} \end{array} = \begin{array}{c} \text{NNA} \\ \text{NN} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{NN} \end{array} + \begin{array}{c} \text{GA} \\ \text{NN} \end{array}$$

There are always exceptions to these general patterns :

$$\begin{array}{c} \text{LL.LLA} \\ \text{LL} \end{array} = \begin{array}{c} \text{LLA} \\ \text{LL} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{LL} \end{array} + \begin{array}{c} \text{LLA} \\ \text{LL} \end{array}$$

The characters that have their final stem turning upwards form vertical ligatures with other characters of the same kind :





















$$\begin{array}{c} \text{C}^{23} \text{CA} \\ \text{C} \end{array} / \begin{array}{c} \text{C}^{23} \\ \text{C} \end{array} = \begin{array}{c} \text{CA} \\ \text{C} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{C} \end{array} + \begin{array}{c} \text{CA} \\ \text{C} \end{array}$$

A ligature can have both horizontal and vertical combinations based on the same logic. The characters that combine vertically are usually formed at the end of such a ligature.

$$\begin{array}{c} \text{K.S.SA} \\ \text{K} \end{array} = \begin{array}{c} \text{KA} \\ \text{K} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{K} \end{array} + \begin{array}{c} \text{SA} \\ \text{K} \end{array} + \begin{array}{c} \text{Joiner} \\ \text{K} \end{array} + \begin{array}{c} \text{SA} \\ \text{K} \end{array}$$

23 Here the triangular form attached to the bottom right of letter CA is a duplication symbol (germination) that also appears with letters BA, VA and YA. This behaviour is not very common in Tulu-Tigalari and seems to be an influence of Malayalam script.












TULU-TIGALARI LETTER MA, TULU-TIGALARI LETTER YA, TULU-TIGALARI LETTER RA, TULU-TIGALARI LETTER LA & TULU-TIGALARI LETTER VA have a combining post-base form that is unrelated to their parent shapes. These characters usually form ligatures with the characters they're combining with.

 K.MA	=	 KA	+	 Joiner	+	 MA
 K.YA	=	 KA	+	 Joiner	+	 YA
 K.RA	=	 KA	+	 Joiner	+	 RA
 K.LA	=	 KA	+	 Joiner	+	 LA
 K.VA	=	 KA	+	 Joiner	+	 VA

The semi-vowel signs that attach below the baseline in a conjunct cluster are attached to the final character (similar to vowel signs that attach below the baseline).

 S.S.VA	=	 SA	+	 Joiner	+	 SA	+	 Joiner	+	 VA
---	---	---	---	---	---	---	---	--	---	---

Ligature forms of conjuncts can appear as post-base forms in a vertical stack. This occurs often when a below-base consonant/semi-vowel combines horizontally with the post-base forms of RA, LA, VA, MA or YA :

 K.SS.NN.YA	=	 KA	+	 Joiner	+	 SSA	+	 Joiner	+	 NNA	+	 Joiner	+	 YA	
				 ↓						 ↓				 ↓	

The above mentioned ways of forming consonant ligatures is not a rule but merely an observation and there are several exceptions to this behaviour.

(b.) [Consonant/Conjunct/Semi-Vowel] + Vowel Sign :

The vowel signs U, UU²⁴, Vocalic R & Vocalic RR combine with other base or post-base consonants/semi-vowels/conjuncts forming ligatures. The vowel signs that appear below the baseline in a conjunct cluster are attached to the final character.






$$\text{K.KU} = \text{KA} + \text{Joiner} + \text{KA} + \text{U-v.s.}$$

$$\text{SS.KRU} = \text{SSA} + \text{Joiner} + \text{KA} + \text{vocalic R-v.s. (Refer Figure 18)}$$

(c.) [Consonant/Conjunct/Semi-Vowel] + Special Character :

In Tulu-Tigalari, this kind of ligatures are seen formed by *Virama* and *Repha* with a select few characters :

The *Virama* ligatures are formed with KA (ක), GA (ග), NA (ඟ), TA (ඟ) & TTA (ඟ/ඟ) (Refer Section 5.4).

Repha ligatures are formed with letters MA  / , YA  & VA /; discussed under Section 8.5.

(d.) Ligating Special Characters :

There is only one found example of a special character ligature so far : *Repha* + *Virama* (ꣳ). This occurs when the character/conjunct following the *Repha* ends with a *Virama* (Refer Figure 19, below.). This ligature form can be handled at a font level. The input sequence for this will be as follows :

$$\text{කේ} = \overset{\cdot}{\text{ෙ}} + \text{ක} + \text{ඌ} + \overset{\cdot}{\text{ඹ}} + \overset{\cdot}{\text{්}}$$

R.K(ඉ:) Repha KA AA-v.s. Virama

This *Repha*+*Virama* ligature follows the character order of *Virama* and not *Repha*.

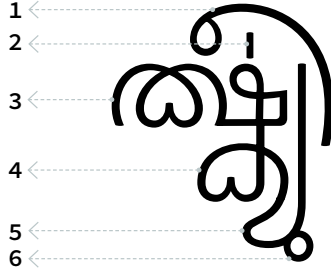
Repha (◌͡) → Consonant (ω) → Vowel (◌͡) = ω͡

5.6 Vertical metrics :

Tulu-Tigalari is seen to have a maximum of six characters in a cluster (Eg.: ಳ್ಲಿೞ್). Characters that form these clusters come together in several ways making Tulu-Tigalari a challenging script to build on a font platform that's made primarily for Lain based scripts (Refer Figures 15, 16, 17) (Refer to the supplementary paper, 'A list of common Tigalari conjuncts' for a list of Tigalari conjunct forms as found in the palm leaf manuscripts.)

24 Various U & UU ligature forms are discussed on pp. 12, 13

To avoid the possibility of an infinite vertical stack, a *Virama* character can be used by the font to break a cluster after three vertically stacking consonants/semi-vowels. Tulu-Tigalari font metrics needs to accommodate up-to six vertical stacks. Below is a representation of this using an abstract character :



6 BASIS FOR GLYPH SHAPES

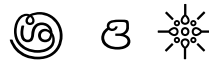
Historically, Tulu-Tigalari letter shapes have undergone several changes across various regions, time periods and materials (as is expected with any script). It is therefore possible to represent only the most commonly used forms while also considering the relevance of several later influences of the surrounding script systems like Kannada, Tamil, Grantha, Nandinagari and Malayalam on Tulu-Tigalari.

The Tulu-Tigalari script is slowly transitioning from a scribal culture to mass literacy—especially in the context of it being adopted to write the Tulu language. This implies the need for Tulu-Tigalari to be standardised; keeping in mind its practical uses for archival, literary and educational purposes. Since this is an early attempt at standardisation; there is a possibility of Tulu-Tigalari evolving quite differently from what is proposed here.

6.1 Alternate Glyph Shapes

Tulu-Tigalari script has been studied by scholars like Venkataraja Puninchathaya, *Shrii* Bannanje Govindacharya, Keladi Gunda Jois, Dr S R Vighnaraj, *Shrii* Ramanath Acharya and *Shri* Krishnaraja Bhat to name a few. After having consulted them regarding this issue, several characters clearly seem to have no resolution for the glyph shapes due to the frequency of their occurrence and the presence of several commonly used alternate glyph shapes as seen below. A few of these alternate shapes appear in sets (as seen grouped together under letters A, AA & O, OO). All the instances of alternate shapes can be addressed using stylistic sets (opentype features) and need not be encoded as separate characters. The exception to this being *Pushpika*. *Pushpika* forms have many variations across manuscripts. This is discussed further under Sections 8.2 - 8.7.

Pushpika



The first glyph (from the left) in the list below is the default form.

Tulu-Tigalari vowels with alternate forms. :

TULU-TIGALARI LETTER A (a)	ᱠᱟ	ᱠᱟᱵ	ᱠᱟᱨ
TULU-TIGALARI LETTER AA (ā)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵᱟ	ᱠᱟᱵᱟ ᱠᱟᱵᱟ
TULU-TIGALARI LETTER II (ī)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵᱟ	
TULU-TIGALARI LETTER UU (ū)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵᱟ	
TULU-TIGALARI LETTER VOCALIC RR (ṛ)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵᱟ (Repha+Voc. R is used)	
TULU-TIGALARI LETTER VOCALIC LL (ḷ)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵᱟ (Repha+Voc. L is used)	
TULU-TIGALARI LETTER E (e)	ᱠᱟᱵ ᱠᱟᱵ		
TULU-TIGALARI LETTER AI (ai)	ᱠᱟᱵ ᱠᱟᱵ		
TULU-TIGALARI LETTER OO (ō)	ᱠᱟᱵ	ᱠᱟᱵ	ᱠᱟᱵ
TULU-TIGALARI LETTER AU (au)	ᱠᱟᱵ	ᱠᱟᱵ	ᱠᱟᱵ

TULU-TIGALARI VOWEL SIGN U & TULU-TIGALARI VOWEL SIGN UU have varying shapes depending on the glyphs they combine with (Refer Section 5.2) (all these shapes belong the same stylistic set of the font and are not alternate shapes as is the case with the other characters listed in this section) :

TULU-TIGALARI VOWEL SIGN U (u)	ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ
TULU-TIGALARI VOWEL SIGN UU (ū)	ᱠᱟᱵ ᱠᱟᱵ

TULU-TIGALARI VOWEL SIGN VOCALIC RR has two varying styles :

TULU-TIGALARI VOWEL SIGN VOCALIC RR (ṛ)	ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ
---	-------------

Consonants and their corresponding below-base forms (*Vattu*) look similar in most cases. The alternate forms of Consonants and their corresponding *Vattu* are listed below :

	CONSONANTS	POST-BASE / BELOW-BASE FORMS
TULU-TIGALARI LETTER KHA (kha)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵ ᱠᱟᱵ
TULU-TIGALARI LETTER GHA (gha)	ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ
TULU-TIGALARI LETTER CHA (cha)	ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵ ᱠᱟᱵ
TULU-TIGALARI LETTER JHA (jha)	ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ	ᱠᱟᱵ ᱠᱟᱵ ᱠᱟᱵ

TULU-TIGALARI LETTER NYA (ña)	ഞ ഞ ഞ	ഞ	ഞ	ഞ
TULU-TIGALARI LETTER DDA (ḍa)	ഡ ഡ	ഡ	ഡ	
TULU-TIGALARI LETTER DDHA (ḍha)	ഢ ഢ	ഢ	ഢ	
TULU-TIGALARI LETTER DA (da)	ദ ദ ദ	ദ	ദ	ദ
TULU-TIGALARI LETTER BHA (bha)	ബ ങ	ബ	ബ	
TULU-TIGALARI LETTER MA (ma)	മ മ മ	മ	മ	മ
TULU-TIGALARI LETTER VA (va)	വ വ	വ	വ	വ
TULU-TIGALARI LETTER LA (ḷa)	ള ള	ള	ള	
TULU-TIGALARI LETTER RRA (ṛa)	റ റ	റ	റ	

Virama sign has two forms (അ & ങ്) in Tulu-Tigalari as discussed under Section 5.4 in detail.

Repha forms a ligature with letters MA (മ / മ), YA (യ) & VA (വ / വ); discussed under Section 8.5.

7 Digits

The most popular convention is to use the Kannada numeral system along with Tulu-Tigalari script (Refer Figure 20). It is recommend to use these characters from the Kannada Unicode block: U+0CE6, U+0CE7, U+0CE8, U+0CE9, U+0CEA, U+0CEB, U+0CEC, U+0CED, U+0CEE & U+0CEF (Section 12 requests an extension of this Kannada block).

There are several script charts that illustrate a set of characters which are popularly called the 'Tulu Numbers'(Refer Figure 6, 21, 22). There characters are rare to come-by in Tulu-Tigalari manuscripts. They need further study before encoding them into the Tulu-Tigalari block.

8 Other / Symbols / Punctuations

Visarga	◌ḥ
Candra Anunasika	◌̣
Anuswara	◌ṁ
Pushpika	◌ṣ̣ ◌ṣ̣ ◌ṣ̣
Tiddu Mark	◌̣+
Anudatta	◌̣
Svarita	◌̣/
Avagraha	◌̣
Repha	◌̣
Dandas	,





8.1 Visarga, Candra Anunasika, Anuswara

Anunasika means to pronounce simultaneously through the nose and mouth. It is not a pure nasalisation (*Anuswara*). In Sankrit, a whole range of sounds are termed *Anunasika*.

In Tulu-Tigalari manuscripts, the *Anunasika* sounds closely follow the Paninian rules of nasalisation using class consonants. A spacing semicircle also represents the *Anunasika* in Tulu-Tigalari, similar to Grantha sign *Candrabindu* U+11301²⁵. The resulting vowel sounds this character affects is produced through both the nose and the mouth, nasalising it in the process (making this an *Anunasika*).

The *Candra Anunasika* mark (◌̣) indicates one of the *Anunasika* sounds similar to a *Candra Bindu* in Devanagari. It is not called *Candrabindu* because this character does not have a dot (*Bindu*) in Tulu-Tigalari.

Attestations for this semi-circular (*Candra*) *Anunasika* form can be found in the document : L2/17-182, Comments on encoding the Tigalari script - Srinidhi A and Sridatta A (5.2 ANUNASIK, p. 13)²⁶. This character can combine with all letters and vowel marks.


 =
 
 +
 
 +
 

 |≈KṨ | KA | 00-v.s. | candra anunasika

²⁵ There is a *Candrabindu* form of *Anunasika* in Tulu-Tigalari (Refer Figure 28). Its use in Tulu-Tigalari is very rare and experimental (found in Tulu Ramayana). The *Candrabindu* form can be added at a later date (if at all) as an alternate form of *Anunasika* if more manuscripts containing *Candrabindu* are found where it represents the *Anunasika* sound.

²⁶ In the document L2/17-182, this character is called *Anunasika*.

A pure nasal sound in Tulu-Tigalari is represented by an *Anuswara* (◌ᳵ). *Anuswara* means that which follows a vowel (where the vowel sound is not disturbed). *Anuswara* is a right side mark and forms a part of the syllable.

$$\begin{array}{c} \text{ᳵ} \\ | \\ \text{KAM} \end{array} = \begin{array}{c} \text{ᳵ} \\ | \\ \text{KA} \end{array} + \begin{array}{c} \text{ᳵ} \\ | \\ \text{anuswara (ᳵ)} \end{array}$$

Visarga (◌ᳶ) indicates a voiceless glottal fricative. It is added to the right of the characters it affects.

$$\begin{array}{c} \text{ᳶ} \\ | \\ \text{KAH} \end{array} = \begin{array}{c} \text{ᳵ} \\ | \\ \text{KA} \end{array} + \begin{array}{c} \text{ᳶ} \\ | \\ \text{visarga (ᳶ)} \end{array}$$

8.2 Pushpika

There are various symbols that are commonly used in Tulu-Tigalari manuscripts which are collectively referred to as *Pushpika* or *Alankaara*²⁷. These decorative punctuations remain to be studied in detail. *Pushpika* is an open-ended symbol employed according to the scribes preference (Refer Figure 23, 24).

The term *Pushpika* is employed in this proposal as its an unambiguous, commonly used term to refer to these characters. *Alankaara* on the other had can also refer to a grammatical construction. The three commonly found *Pushpika* in Tulu-Tigalari manuscripts are :

Om Pushpika

Shrii Pushpika

Pushpa

We often find all three of these symbols appearing in a single manuscript and therefore encoding them will be very useful for digitising and documenting manuscripts.

The *Om* and *Shrii Pushpika* are very similar in their use. They are often elaborately drawn and stand-out on a page. There is no formal rule that dictates their use. These symbols serve several functions :

When a row of *Om* or *Shrii Pushpika* symbols appear between two verses, it could indicate :

- A pause of a certain length before reciting the next verse.
- To cover the imperfections on a palm leaf.
- A space-filler to make a page look evenly grey when there is a large amount of empty space.
- To repeatedly recite *Om/Shrii*.
- End of a sentence/paragraph/verse/chapter/subject/book.

²⁷ Tulu-Tigalari manuscripts have several symbols that appear decorative. These symbols have not been studied closely and might be worth examining. Similar symbols appear in several manuscripts and stone inscriptions across most Brahmic script systems.

- |೩| / |ೞ| Can indicate end of a sentence/paragraph/verse
- ||೩|| / ||ೞ|| Can indicate end of a sentence/paragraph/verse
- ೩೩ / ೞೞ Can indicate end of a sentence/paragraph/verse.

***Om Pushpika* (೩) :**

This *Pushpika* symbol seems to be a stylised Tulu-Tigalari *Om* ²⁸. Similar to Shrii Pushpika, Om has 2 forms as illustrated below. Both the forms appear with the same manuscript. While form 1 is used exclusively to indicate the sound OM, form 2 can be used for both OM as well as indicators for beginnings, pauses, endings or space fillers (Refer Figure 23). There are several variations of this *Om Pushpika* that are seen across manuscripts.

$$1. \quad \text{ೞ}^\circ = \text{ೞ} + \text{ೞ}^\circ$$

| OM | 00 | Anuswara

$$2. \quad \text{೩}$$

***Shrii Pushpika* (ೞೞ) :**

The *Shrii* ligature in Tulu-Tigalari has two forms as illustrated below under 1 & 2. The *Shrii Pushpika* closely resembles the *Shrii* ligature (2 & 3). Various forms of *Pushpika* are found with dramatic flourishes (Refer Figure 24). The interpretation of the *Shrii Pushpika* will therefore depend on the scribe or the type designer in this case.

$$1. \quad \text{ೞೞ} = \text{ೞ} + \text{ೞ}^\circ + \text{ೞ} + \text{ೞ}^\circ$$

| SH.RII | SHA | virama | RA | II-v.s.

$$2. \quad \text{ೞೞ} = \text{ೞ} + \text{ೞ}^\circ + \text{ೞ} + \text{ೞ}^\circ$$

| SH.RII | SHA | virama | RA | II-vs

$$3. \quad \text{ೞೞ}$$

These *Shrii liagure* and *Shrii Pushpika* are semantically different and use different code points, despite being visually similar. All the above mentioned forms occur often within the same manuscript, the *Shrii Pushpika* therefore needs to be encoded as a separate character.

***Pushpa* (ೞೞ) :**

This symbol is identified as either an abstraction of an eight petalled lotus or a *Sudarshana Chakra*. It is most commonly seen as marginalia marking an important chapter. It is also used in-line to indicate chapter endings or to draw attention to a particular portion of the text.

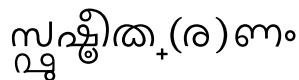
²⁸ Some scholars like Shrii. Krishnaraja Bhat and Ramanatha Achar are of the opinion that this character might be an abstraction of the 'Om' symbol.

8.3 *Tiddu* mark : Correction / Insertion mark :

*Tiddu*²⁹, a correction or insertion mark (◌₊) in Tulu-Tigalari behaves very similar to a 'caret' and is an editor's mark. *Tiddu* mark is used to indicate misspellings and insertions. This symbol is found in many manuscripts and looks like a small plus sign (Refer Figure 25). There is no particular rule to govern its placement. It tends to orbit around a glyph/conjunct or word that its pointing to as an error. We often find the corrections written alongside, above or below the baseline (where it usually appears in the opposite direction of the *Tiddu* mark). These corrections are often seen not inked-in as they were inscribed at a later stage (most often by the same scribe while reading from a newly inked palm leaf manuscript).

It is advisable to use this as merely a visual symbol indicating a mistake or a correction. This proposal recommends using this *Tiddu* mark as an over-hanging right spacing sign placed after the glyph/conjunct or word. This placement avoids confusion with the common PLUS SIGN (+). The conventions for its use can be determined by the user.

To illustrate its use :

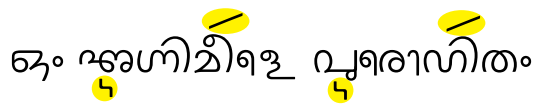

 S . PU . SS . TTHI . KA . . (RA) . NNAM

8.4 Vedic Tone Marks

Tulu-Tigalari manuscripts have many Vedic marks³⁰. The whole repertoire of these symbols needs to be added to the Tulu-Tigalari block at a later date after studying them closely.

Svarita (◌̣) and *Anudatta* (◌̤) are the two most commonly found Vedic Tone (*Swara*) marks in Tulu-Tigalari script. They are non-spacing signs (Refer Figure 26). *Svarita* and *Anudatta* are added centred directly above and below a cluster respectively.³¹

To illustrate its use :


Om̐ agnimīṛya purohitam

²⁹ This mark is described as Kaakapaada or Hamsapaada in the book by Burnell, A. C. : Elements of South-Indian Palaeography from the Fourth to the Seventeenth Century A.D., 1878, p. 83. Following this description, this character is often referred to as Kākapāda (crow's foot), Kraunchapāda (crane's foot) or Hamsapāda (swan's foot) which are also marks used in classical music. Author feels its better to use the more commonly used term *Tiddu*, to avoid confusion with the musical notation.

³⁰ Discussed in another unicode proposal by Srinidhi : <http://www.unicode.org/L2/L2015/15101-vedic.pdf>
 Further comments on this : <http://www.unicode.org/L2/L2015/15113-vedic-nondeva-cmt.pdf>

³¹ *Udatta* is generally left unmarked.

8.5 Repha

Repha is also called *Arka Vottu* in Tulu-Tigalari/Kannada. The use of *Repha* instead of *Reph* for Tulu-Tigalari is recommended.

A Repha is typically rendered as a special symbol when RA+Virama precedes a consonant/semi-vowel. This behaviour is common to many Indic scripts.

Adding Repha as an independent character (𑌕) is proposed for Tulu-Tigalari.

In Tulu-Tigalari, Cluster initial RA has three forms :

(a.) Explicit initial RA in a cluster

(b.) As a Combining Mark : Repha - 𑌕

(c.) As a special Conjunct : Repha Ligature = Repha (𑌕) + Joiner (𑌕)

(a.) Explicit initial RA in a cluster :

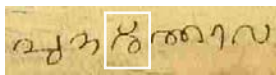
The initial RA+Virama in a conjunct sequence is used independently as seen in several manuscripts. It is also used to represent Tulu special vowel ॐ (Rॐ : 𑌕) where a Virama is used explicitly. This behaviour is common in the Tulu language manuscripts.

The automatic conversion of RA+Virama sequence needs to be disallowed in Tulu-Tigalari for better control over RA conjuncts, RA+Virama, Repha & Repha ligature forms.

The RA+Virama sequence commonly used to represent the Tulu language C-M-C-U Letter A/U :

𑌕𑌕 = 𑌕 + 𑌕 + 𑌕

|R.YA |RA |Virama |YA



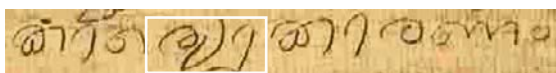
EXAMPLE 6: PuDAR₂TTAaVA. Tulu language manuscript.

(SOURCE) Anantavruta Kathe, Govinda Pai Research Centre, Udupi

The RA is used as a base glyph in conjuncts and the Repha behaviour is ignored :

𑌕𑌕 = 𑌕 + 𑌕 + 𑌕

|R.YA |RA |Joiner |YA



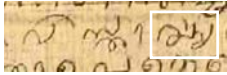
EXAMPLE 7: KAaRYoKAaRANNA_m. Tulu language manuscript.

(SOURCE) Anantavruta Kathe, Govinda Pai Research Centre, Udupi

(b.) As a Combining Mark : Repha – ☐

Tulu-Tigalari uses a Repha form that is placed above the base consonant/conjunct to represent : RA+Virama (☐). Encoding the Repha as a separate character is required to avoid extensive use of ZWJ. The conventional Repha form appears as illustrated below. The short vertical line placed above the base glyph :

$$\begin{array}{c} \text{R.YA} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{YA} \end{array}$$



EXAMPLE 8 : ViSTAaRYYA, Tulu language manuscript.

(SOURCE) Anantavruta Kathe, Govinda Pai Research Centre, Udupi

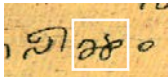
[Repha + Virama] forms a mark conjunct in Tulu-Tigalari. This can be handled at font level. The input sequence is as follows :

$$\begin{array}{c} \text{R.K(ə:)} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{KA} \end{array} + \begin{array}{c} \text{AA-v.s.} \end{array} + \begin{array}{c} \text{Virama} \end{array}$$

(c.) As a special Conjunct : Repha Ligature = Repha (☐) + Joiner (☐)

Repha can also form a conjunct with base consonants MA : ೀ / ು; YA : ೂ & VA : ೃ / ೄ following the Repha. This conjunct form of Repha can be called by adding a Joiner (☐) following the Repha.

$$\begin{array}{c} \text{R.YA} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{Joiner} \end{array} + \begin{array}{c} \text{YA} \end{array}$$



EXAMPLE 9 : ViRYAm, Sanskrit language manuscript.

(SOURCE) Ramayana, Dodmane, Udupi.

Repha ligature can combine with other combining forms. Therefore it is not necessary to restrict such behaviour :

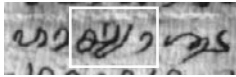
$$\begin{array}{c} \text{R.Y.YA} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{Joiner} \end{array} + \begin{array}{c} \text{YA} \end{array} + \begin{array}{c} \text{Joiner} \end{array} + \begin{array}{c} \text{YA} \end{array}$$



EXAMPLE 10: Left : RYYAa. Right : RYVAaa. Sanskrit language manuscript.
(SOURCE) Srinidhi A

It is up-to the font developers to determine the complexity of conjunct behaviour for Tulu-Tigalari script. The above sequence of RYYA can also be treated as follows :

$$\begin{array}{c} \text{R.Y.YA} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{YA} \end{array} + \begin{array}{c} \text{Joiner} \end{array} + \begin{array}{c} \text{YA} \end{array}$$



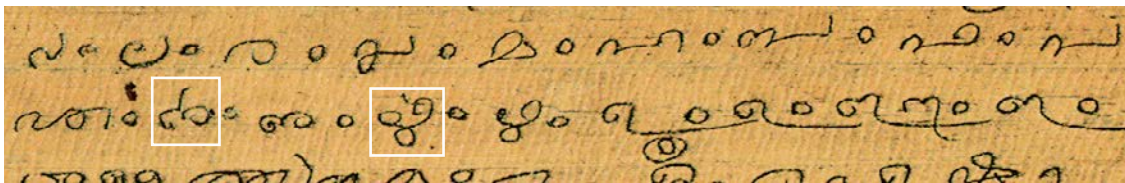
EXAMPLE 11 : RYYAa. Sanskrit language manuscript.
(SOURCE) Sarvamūlagrantha, Krishna Matha, Udupi

Notes on Repha combining with Vowels :

In several Tulu-Tigalari manuscripts we find the Repha combining with the Vowels Vocalic R & Vocalic L to represent Vocalic RR & Vocalic LL respectively. These forms need not be encoded separately and a regular input sequence as illustrated below can be employed :

$$\begin{array}{c} \text{Vocalic RR} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{Vocalic R} \end{array}$$

$$\begin{array}{c} \text{Vocalic LL} \end{array} = \begin{array}{c} \text{Repha} \end{array} + \begin{array}{c} \text{Vocalic L} \end{array}$$







EXAMPLE 12 : A Nyasa text illustrating the Vocalic LL (left) and Vocalic RR (right) represented with a combining Repha. Sanskrit language manuscript.
(SOURCE) From a private collection, Udupi

Visual Placement of Repha :

There are two ways of visually representing *Repha*. Its to be noted here that the positioning of Repha while encoding it should precede the consonant always³². The two visual placements for Repha are as follows :





1. To the right of the character/conjunct :

The advantage of this version is that it saves space vertically.


Repha () → Character () → Vowel Mark () = 

2. Directly above (centred) a character/conjunct :



This placement is most commonly seen used in manuscripts and is the recommended form with all characters.

Repha () → Character () → Vowel Mark () = 

8.6. Avagraha

Tulu-Tigalari *Avagraha* () follows the Devanagari (U+093D) Malayalam (U+0D3D) model and can be encoded on similar lines.

8.7 Danda (Single & Double)

Danda () and *Double-Danda* () are commonly seen in Tulu-Tigalari manuscripts. These can be encoded for Tulu-Tigalari as using script specific *Danda(s)* will help in type-setting in a multi-script environment. Legacy issues can also be avoided by including the *Danda(s)* right from the beginning.

8.8 Other

Other punctuation marks like the question mark, semicolon, ellipses, single and double quotation marks, mathematical notations etc., is used as is from the Latin script and would not require separate code points for Tulu-Tigalari.

³² At the time of making alternate conjunct forms, it is useful to note that Tulu-Tigalari has a conjunct form of *Repha* character that appears in a few manuscripts as indicated in the document 'L2/17-182, Comments on encoding the Tulu-Tigalari script'. The alternate form attestations and behaviour are on pages 16 & 18. These forms as mentioned are rare and need not be a part of the standard behaviour.

9 Script Behaviour Summary

Going over what's already discussed in earlier; the inherent vowel 'A' can be suppressed by adding a *Virama*. *Virama* also represents the Tulu special vowels : 9, 9:, ε & ε: (discussed in Section 5.4).

$$\begin{array}{ccccc}
 \text{𑌕} & = & \text{𑌕} & + & \text{𑌖} \\
 |K(9) & & |KA & & |virama \\
 \\
 \text{𑌕𑌖} & = & \text{𑌕} & + & \text{𑌖} + \text{𑌖} \\
 |K(9:) & & |KA & & |EE-v.s. |virama
 \end{array}$$

The Looped Virama character is used to call the Virama ligatures that form with KA 𑌕, GA 𑌔, TTA 𑌕/𑌔, TA 𑌕 & NA 𑌕

$$\begin{array}{ccccc}
 \text{𑌕} & = & \text{𑌕} & + & \text{𑌖} \\
 |K & & |KA & & |L.Vir
 \end{array}$$

The consonant clusters form a complex entity. The consonants are read from left to right and top to bottom. The inherent vowel 'A' is carried to the final consonant in a conjunct. The Joiner character is used to create ligatures :

$$\begin{array}{ccccc}
 \text{𑌕𑌖} & = & \text{𑌕} & + & \text{𑌖} + \text{𑌖} \\
 |K.KHA & & |KA & & |Joiner |KHA
 \end{array}$$

When a vowel sign is added to a character/conjunct, the inherent vowel 'A' is replaced by the new vowel indicated by the corresponding vowel sign and carried to final consonant in a conjunct.

$$\begin{array}{ccccc}
 \text{𑌕𑌖} & = & \text{𑌕} & + & \text{𑌖} + \text{𑌖} + \text{𑌖} \\
 |K.KHII & & |KA & & |Joiner |KHA |II-v.s. \\
 & & >K + A & & -A & >KH + A & -A + II
 \end{array}$$

A few vowel signs reorder to appear before a consonant/conjunct, but is read after³³:

$$\begin{array}{ccccc}
 \text{𑌕𑌖} & = & \text{𑌕} & + & \text{𑌖} \\
 |KEE & & |KA & & |EE-v.s. \\
 \\
 \text{𑌕𑌖} & = & \text{𑌕} & + & \text{𑌖} \\
 |KAI & & |KA & & |AI-v.s.
 \end{array}$$

³³ The method of writing or reading this is subjective. We see clusters written in two ways: (1) The order of reading, that is, the consonant/consonant-cluster is written first and the vowel sign added to it later, making the direction from right to left in case of re-ordering vowel marks; or, (2) The vowel sign added in the order of writing. That is, from left to right. Most software today add the vowel sign after entering the consonants(s).

Two part vowel signs appear before and after a consonant/conjunct and is read after :

$$\begin{array}{c} \text{ಕಾಊ} \\ | \text{KAU} \end{array} = \begin{array}{c} \text{ಕಾ} \\ | \text{KA} \end{array} + \begin{array}{c} \text{ಊ} \\ | \text{AU-v.s.} \end{array}$$

Repha is used to indicate : RA+Virama that precedes a vowel/consonant/semi-vowel.

$$\begin{array}{c} \text{ರ.ಯಾ} \\ | \text{R.YA} \end{array} = \begin{array}{c} \text{ರೇಫ} \\ | \text{Reph} \end{array} + \begin{array}{c} \text{ಯಾ} \\ | \text{YA} \end{array}$$

The Reph forms a conjunct with consonants—MA ಫ / ಫ, YA ಫ & VA ಫ / ಫ. A Joiner character is used after Reph to form this ligature with the following character.

$$\begin{array}{c} \text{ರ.ಯಾ} \\ | \text{R.YA} \end{array} = \begin{array}{c} \text{ರೇಫ} \\ | \text{Reph} \end{array} + \begin{array}{c} \text{ಜೋನರ್} \\ | \text{Joiner} \end{array} + \begin{array}{c} \text{ಯಾ} \\ | \text{YA} \end{array}$$

Script specific *Danda* (|) and Double-*Danda* (||) are proposed.

Characters like Vowel O, Vowel E and their respective vowel marks are required to adequately represent the Tulu language in this script. However, since these character are recent and not yet in a standardised form, it would be advisable to retain the empty slots in the table for future encoding of these characters.

Kannada numeral system along with Tulu-Tigalari is recommend to use from the Kannada Unicode block: U+0CE6, U+0CE7, U+0CE8, U+0CE9, U+0CEA, U+0CEB, U+0CEC, U+0CED, U+0CEE & U+0CEF The 'Tulu Numbers' that appear in Figure 6, 21, 22 are rare. Space is reserved for future encoding of these characters after further study.

11380

Tigalari

113FF

	1138	1139	113A	113B	113C	113D	113E	113F
0	അ 11380	ഒ 11390	നെ 113A0	ഷ 113B0	ശ്ശ 113C0	ട 113D0	<<UDATTA>> 113E0	<<NUH>> 113F0
1	ഏ 11381	ഈ 11391	ത 113A1	സ 113B1	<<VS.E>> 113C1	ട 113D1	ട 113E1	<<NUH>> 113F1
2	ഗ 11382	ക 11392	ല 113A2	ന 113B2	ര 113C2	<<GERMIN- ATION>> 113D2	ര 113E2	<<NUH>> 113F2
3	എ 11383	ഘ 11393	ദ 113A3	മ 113B3	<<VS. AE>> 113C3	ട 113D3	<<JHVA.>> 113E3	<<NUH>> 113F3
4	ഉ 11384	ഗ 11394	ധ 113A4	ഃ 113B4	<<VS. AEE>> 113C4	 113D4	<<UPAD.>> 113E4	<<NUH>> 113F4
5	ഘ 11385	ഘ 11395	ന 113A5	ഃ 113B5	ര 113C5	 113D5	<<VEDIC CHARS.>> 113E5	<<NUH>> 113F5
6	ഘ 11386	ന 11396	വ 113A6	<<NNNA>> 113B6	<<VS.O>> 113C6	<<ALT. STOP>> 113D6	<<VEDIC CHARS.>> 113E6	<<NUH>> 113F6
7	ഘ 11387	ച 11397	വ 113A7	ഃ 113B7	ര 113C7	ഭ 113D7	<<VEDIC CHARS.>> 113E7	<<NUH>> 113F7
8	ഘ 11388	ഘ 11398	വ 113A8	ഃ 113B8	ര 113C8	ഭ 113D8	<<VEDIC CHARS.>> 113E8	<<NUH>> 113F8
9	ഘ 11389	ഘ 11399	വ 113A9	ഃ 113B9	ര 113C9	ഭ 113D9	<<VEDIC CHARS.>> 113E9	<<NUH>> 113F9
A	<<E>> 1138A	ഘ 1139A	മ 113AA	ഃ 113BA	ര 113CA	<<SYMBOLS /PUNCT.>> 113DA	<<VEDIC CHARS.>> 113EA	<<NUH>> 113FA
B	ഘ 1138B	ഘ 1139B	ഘ 113AB	ഃ 113BB	<<ALT. ANUNASIK>> 113CB	<<SYMBOLS /PUNCT.>> 113DB	<<VEDIC CHARS.>> 113EB	<<NUH>> 113FB
C	<<AE>> 1138C	ഘ 1139C	ര 113AC	ഃ 113BC	ര 113CC	<<SYMBOLS /PUNCT.>> 113DC	<<VEDIC CHARS.>> 113EC	<<NUH>> 113FC
D	<<AEE>> 1138D	ഘ 1139D	ഃ 113AD	ഃ 113BD	ര 113CD	<<SYMBOLS /PUNCT.>> 113DD	<<VEDIC CHARS.>> 113ED	<<NUH>> 113FD
E	ര 1138E	ഘ 1139E	ഃ 113AE	ഃ 113BE	ര 113CE	<<SYMBOLS /PUNCT.>> 113DE	<<VEDIC CHARS.>> 113EE	<<NUH>> 113FE
F	<<O>> 1138F	ഘ 1139F	ഃ 113AF	ഃ 113BF	ര 113CF	<<SYMBOLS /PUNCT.>> 113DF	<<VEDIC CHARS.>> 113EF	<<NUH>> 113FF

10 Implementation

INDEPENDENT VOWELS :

11380	ಅ	TULU-TIGALARI LETTER A
11381	ಆ	TULU-TIGALARI LETTER AA
11382	ಇ	TULU-TIGALARI LETTER I
11383	ಀ	TULU-TIGALARI LETTER II
11384	ಁ	TULU-TIGALARI LETTER U
11385	ಃ	TULU-TIGALARI LETTER UU
11386	ಋ	TULU-TIGALARI LETTER VOCALIC R
11387	ೠ	TULU-TIGALARI LETTER VOCALIC RR
11388	ಌ	TULU-TIGALARI LETTER VOCALIC L
11389	ೡ	TULU-TIGALARI LETTER VOCALIC LL
1138A	---	<<RESERVED FOR E>>
1138B	ಋ	TULU-TIGALARI LETTER EE
1138C	---	<<RESERVED FOR AE>>
1138D	---	<<RESERVED FOR AEE>>
1138E	ಋ	TULU-TIGALARI LETTER AI
1138F	---	<<RESERVED FOR O>>
11390	ಋ	TULU-TIGALARI LETTER OO
11391	ಋ	TULU-TIGALARI LETTER AU

CONSONANTS :

11392	ಕ	TULU-TIGALARI LETTER KA
11393	ಖ	TULU-TIGALARI LETTER KHA
11394	ಗ	TULU-TIGALARI LETTER GA
11395	ಘ	TULU-TIGALARI LETTER GHA

11396	ᳵ	TULU-TIGALARI LETTER NGA
11397	ᳶ	TULU-TIGALARI LETTER CA
11398	᳷	TULU-TIGALARI LETTER CHA
11399	᳸	TULU-TIGALARI LETTER JA
1139A	᳹	TULU-TIGALARI LETTER JHA
1139B	ᳺ	TULU-TIGALARI LETTER NYA
1139C	᳻	TULU-TIGALARI LETTER TTA
1139D	᳼	TULU-TIGALARI LETTER TTHA
1139E	᳽	TULU-TIGALARI LETTER DDA
1139F	᳾	TULU-TIGALARI LETTER DDHA
113A0	᳿	TULU-TIGALARI LETTER NNA
113A1	᳠	TULU-TIGALARI LETTER TA
113A2	᳡	TULU-TIGALARI LETTER THA
113A	᳢	TULU-TIGALARI LETTER DA
113A4	᳣	TULU-TIGALARI LETTER DHA
113A5	᳤	TULU-TIGALARI LETTER NA
113A6	᳥	TULU-TIGALARI LETTER PA
113A7	᳦	TULU-TIGALARI LETTER PHA
113A8	᳧	TULU-TIGALARI LETTER BA
113A9	᳨	TULU-TIGALARI LETTER BHA
113AA	ᳩ	TULU-TIGALARI LETTER MA
113AB	ᳪ	TULU-TIGALARI LETTER YA
113AC	ᳫ	TULU-TIGALARI LETTER RA
113AD	ᳬ	TULU-TIGALARI LETTER LA
113AE	᳭	TULU-TIGALARI LETTER VA
113AF	ᳮ	TULU-TIGALARI LETTER SHA
113B0	ᳯ	TULU-TIGALARI LETTER SSA
113B1	ᳰ	TULU-TIGALARI LETTER SA
113B2	ᳱ	TULU-TIGALARI LETTER HA

113B3	ꣳ	TULU-TIGALARI LETTER LLA
113B4	ꣴ	TULU-TIGALARI LETTER RRA
113B5	ꣵ	TULU-TIGALARI LETTER LLLA
113B6	---	<<RESERVED FOR NNNA>>

OTHER LETTERS :

113B7	ꣶ	TULU-TIGALARI SIGN AVAGRAHA
-------	---	-----------------------------

VOWEL SIGNS :

113B8	ꣷ	TULU-TIGALARI VOWEL SIGN AA
113B9	꣸	TULU-TIGALARI VOWEL SIGN I
113BA	꣹	TULU-TIGALARI VOWEL SIGN II
113BB	꣺	TULU-TIGALARI VOWEL SIGN U
113BC	ꣻ	TULU-TIGALARI VOWEL SIGN UU
113BD	꣼	TULU-TIGALARI VOWEL SIGN VOCALIC R
113BE	ꣽ	TULU-TIGALARI VOWEL SIGN VOCALIC RR
113BF	ꣾ	TULU-TIGALARI VOWEL SIGN VOCALIC L
113C0	ꣿ	TULU-TIGALARI VOWEL SIGN VOCALIC LL
113C1	---	<<RESERVED FOR VOWEL SIGN E>>
113C2	ꣻꣾ	TULU-TIGALARI VOWEL SIGN EE
113C3	---	<<RESERVED FOR VOWEL SIGN AE>>
113C4	---	<<RESERVED FOR VOWEL SIGN AEE>>
113C5	ꣻꣾꣾ	TULU-TIGALARI VOWEL SIGN AI
113C6	---	<<RESERVED FOR VOWEL SIGN O>>
113C7	ꣻꣾꣷ	TULU-TIGALARI VOWEL SIGN OO
113C8	ꣻꣾ꣺	TULU-TIGALARI VOWEL SIGN AU

VARIOUS SIGNS :

113C9		TULU-TIGALARI AU LENGTH MARK
113CA		TULU-TIGALARI SIGN CANDRA ANUNASIKA
113CB	---	<<RESERVED FOR ALTERNATE ANUNASIKA>>
113CC		TULU-TIGALARI SIGN ANUSVARA
113CD		TULU-TIGALARI SIGN VISARGA
113CE		TULU-TIGALARI SIGN VIRAMA
113CF		TULU-TIGALARI SIGN LOOPED VIRAMA
113D0		TULU-TIGALARI JOINER
		• CREATES CONJUNCTS
113D1		TULU-TIGALARI REPHA
		• PLACED BEFORE A CONSONANT
113D2	---	<<RESERVED FOR GEMINATION SIGN>>
113D3		TULU-TIGALARI SIGN TIDDU

PUNCTUATION :

113D4		TULU-TIGALARI DANDA
113D5		TULU-TIGALARI DOUBLE DANDA
113D6	---	<<RESERVED FOR ALTERNATE STOP>>
113D7		TULU-TIGALARI SIGN OM PUSHPIKA
113D8		TULU-TIGALARI SIGN SHRII PUSHPIKA
113D9		TULU-TIGALARI SIGN PUSHPA

VEDIC CHARACTERS :

113E0	---	<<RESERVED FOR UDATTA>>
113E1		TULU-TIGALARI VEDIC TONE ANUDATTA
113E2		TULU-TIGALARI VEDIC TONE SVARITA
113E3	---	<<RESERVED FOR JIHVAMULYA>>
113E4	---	<<RESERVED FOR UPADHMANIYA>>

10.1 Collation

A < AA < I < II < U < UU < Voc R < Voc RR < Voc L < Voc LL < EE < AI < OO < AU < KA < KHA < GA < GHA < NGA < CA < CHA < JA < JHA < NYA < TTA < TTHA < DDA < DDHA < NNA < TA < THA < NA < PA < PHA < BA < BHA < MA < YA < RA < REPHA < LA < VA < SHA < SSA < SA < HA < RRA < LLA < LLLA < AVAGRAHA < V.S. AA < V.S. I < VS. II < V.S. U < V.S. UU < V.S. Voc R < V.S. Voc RR < V.S. Voc. L < V.S. Voc LL << V.S. EE < V.S. AI < V.S. O < V.S. OO < V.S. AU < V.S. AU Length Mark < VIRAMA < LOOPED VIRAMA < JOINER < TIDDU

10.2 Character properties :

11380;TULU-TIGALARI LETTER A;Lo;0;L;;;;;N;;;;;
 11381;TULU-TIGALARI LETTER AA;Lo;0;L;;;;;N;;;;;
 11382;TULU-TIGALARI LETTER I;Lo;0;L;;;;;N;;;;;
 11383;TULU-TIGALARI LETTER II;Lo;0;L;;;;;N;;;;;
 11384;TULU-TIGALARI LETTER U;Lo;0;L;;;;;N;;;;;
 11385;TULU-TIGALARI LETTER UU;Lo;0;L;;;;;N;;;;;
 11386;TULU-TIGALARI LETTER VOCALIC R;Lo;0;L;;;;;N;;;;;
 11387;TULU-TIGALARI LETTER VOCALIC RR;Lo;0;L;;;;;N;;;;;
 11388;TULU-TIGALARI LETTER VOCALIC L;Lo;0;L;;;;;N;;;;;
 11389;TULU-TIGALARI LETTER VOCALIC LL;Lo;0;L;;;;;N;;;;;
 1138B;TULU-TIGALARI LETTER EE;Lo;0;L;;;;;N;;;;;
 1138E;TULU-TIGALARI LETTER AI;Lo;0;L;;;;;N;;;;;
 11390;TULU-TIGALARI LETTER OO;Lo;0;L;;;;;N;;;;;
 11391;TULU-TIGALARI LETTER AU;Lo;0;L;1138E 113C3;;;;;N;;;;;
 11392;TULU-TIGALARI LETTER KA;Lo;0;L;;;;;N;;;;;
 11393;TULU-TIGALARI LETTER KHA;Lo;0;L;;;;;N;;;;;
 11394;TULU-TIGALARI LETTER GA;Lo;0;L;;;;;N;;;;;
 11395;TULU-TIGALARI LETTER GHA;Lo;0;L;;;;;N;;;;;
 11396;TULU-TIGALARI LETTER NGA;Lo;0;L;;;;;N;;;;;
 11397;TULU-TIGALARI LETTER CA;Lo;0;L;;;;;N;;;;;
 11398;TULU-TIGALARI LETTER CHA;Lo;0;L;;;;;N;;;;;
 11399;TULU-TIGALARI LETTER JA;Lo;0;L;;;;;N;;;;;
 1139A;TULU-TIGALARI LETTER JHA;Lo;0;L;;;;;N;;;;;
 1139B;TULU-TIGALARI LETTER NYA;Lo;0;L;;;;;N;;;;;
 1139C;TULU-TIGALARI LETTER TTA;Lo;0;L;;;;;N;;;;;

1139D;TULU-TIGALARI LETTER TTHA;Lo;0;L;;;;;N;;;;;
 1139E;TULU-TIGALARI LETTER DDA;Lo;0;L;;;;;N;;;;;
 1139F;TULU-TIGALARI LETTER DDHA;Lo;0;L;;;;;N;;;;;
 113A0;TULU-TIGALARI LETTER NNA;Lo;0;L;;;;;N;;;;;
 113A1;TULU-TIGALARI LETTER TA;Lo;0;L;;;;;N;;;;;
 113A2;TULU-TIGALARI LETTER THA;Lo;0;L;;;;;N;;;;;
 113A3;TULU-TIGALARI LETTER DA;Lo;0;L;;;;;N;;;;;
 113A5;TULU-TIGALARI LETTER DHA;Lo;0;L;;;;;N;;;;;
 113A5;TULU-TIGALARI LETTER NA;Lo;0;L;;;;;N;;;;;
 113A6;TULU-TIGALARI LETTER PA;Lo;0;L;;;;;N;;;;;
 113A7;TULU-TIGALARI LETTER PHA;Lo;0;L;;;;;N;;;;;
 113A8;TULU-TIGALARI LETTER BA;Lo;0;L;;;;;N;;;;;
 113A9;TULU-TIGALARI LETTER BHA;Lo;0;L;;;;;N;;;;;
 113AA;TULU-TIGALARI LETTER MA;Lo;0;L;;;;;N;;;;;
 113AB;TULU-TIGALARI LETTER YA;Lo;0;L;;;;;N;;;;;
 113AC;TULU-TIGALARI LETTER RA;Lo;0;L;;;;;N;;;;;
 113AD;TULU-TIGALARI LETTER LA;Lo;0;L;;;;;N;;;;;
 113AE;TULU-TIGALARI LETTER VA;Lo;0;L;;;;;N;;;;;
 113AF;TULU-TIGALARI LETTER SHA;Lo;0;L;;;;;N;;;;;
 113B0;TULU-TIGALARI LETTER SSA;Lo;0;L;;;;;N;;;;;
 113B1;TULU-TIGALARI LETTER SA;Lo;0;L;;;;;N;;;;;
 113B2;TULU-TIGALARI LETTER HA;Lo;0;L;;;;;N;;;;;
 113B3;TULU-TIGALARI LETTER LLA;Lo;0;L;;;;;N;;;;;
 113B4;TULU-TIGALARI LETTER RRA;Lo;0;L;;;;;N;;;;;
 113B5;TULU-TIGALARI LETTER LLLA;Lo;0;L;;;;;N;;;;;
 113B7;TULU-TIGALARI SIGN AVAGRAHA;Lo;0;L;;;;;N;;;;;
 113B8;TULU-TIGALARI VOWEL SIGN AA;Mc;0;L;;;;;N;;;;;
 113B9;TULU-TIGALARI VOWEL SIGN I;Mc;0;L;;;;;N;;;;;
 113BA;TULU-TIGALARI VOWEL SIGN II;Mc;0;L;;;;;N;;;;;
 113BB;TULU-TIGALARI VOWEL SIGN U;Mn;0;NSM;;;;;N;;;;;
 113BC;TULU-TIGALARI VOWEL SIGN UU;Mn;0;NSM;;;;;N;;;;;
 113BD;TULU-TIGALARI VOWEL SIGN VOCALIC R;Mn;0;NSM;;;;;N;;;;;
 113BE;TULU-TIGALARI VOWEL SIGN VOCALIC RR;Mn;0;NSM;;;;;N;;;;;
 113BF;TULU-TIGALARI VOWEL SIGN VOCALIC L;Mn;0;NSM;;;;;N;;;;;
 113C0;TULU-TIGALARI VOWEL SIGN VOCALIC LL;Mn;0;NSM;;;;;N;;;;;
 113C2;TULU-TIGALARI VOWEL SIGN EE;Mc;0;L;;;;;N;;;;;
 113C5;TULU-TIGALARI VOWEL SIGN AI;Mc;0;L;;;;;N;;;;;
 113C7;TULU-TIGALARI VOWEL SIGN OO;Mc;0;L;113BF 113B5;;;;;N;;;;;

```

113C8;TULU-TIGALARI VOWEL SIGN AU;Mc;0;L;113BF 113C4;;;N;;;;;
113C9;TULU-TIGALARI AU LENGTH MARK;Mc;0;L;;;N;;;;;
113CA;TULU-TIGALARI SIGN CANDRA ANUNASIKA;Mc;0;L;;;N;;;;;
113CC;TULU-TIGALARI SIGN ANUSVARA;Mc;0;L;;;N;;;;;
113CD;TULU-TIGALARI SIGN VISARGA;Mc;0;L;;;N;;;;;
113CE;TULU-TIGALARI SIGN VIRAMA;Mn;9;NSM;;;N;;;;;
113CF;TULU-TIGALARI SIGN LOOPED VIRAMA;Mn;9;NSM;;;N;;;;;
113D0;TULU-TIGALARI JOINER;Mn;9;NSM;;;N;;;;;
113D1;TULU-TIGALARI REPHA;Lo;0;L;;;N;;;;;
113D3;TULU-TIGALARI SIGN TIDDU;Mn;220;NSM;;;N;;;;;
113D4;TULU-TIGALARI DANDA;Po;0;L;;;N;;;;;
113D5;TULU-TIGALARI DOUBLE DANDA;Po;0;L;;;N;;;;;
113D7;TULU-TIGALARI SIGN OM PUSHPIKA;Po;0;L;;;N;;;;;
113D8;TULU-TIGALARI SIGN SHRII PUSHPIKA;Po;0;L;;;N;;;;;
113D9;TULU-TIGALARI SIGN PUSHPIKA;Po;0;L;;;N;;;;;
113E1;TULU-TIGALARI VEDIC TONE SVARITA;Mn;230;NSM;;;N;;;;;
113E2;TULU-TIGALARI VEDIC TONE ANUDATTA;Mn;230;NSM;;;N;;;;;

```

10.3 Indic Syllable Category :

```

# Indic_Syllabic_Category=Bindu
113CA      ; Bindu # Mc      TULU-TIGALARI SIGN CANDRA ANUNASIKA
113CC      ; Bindu # Mc      TULU-TIGALARI SIGN ANUSVARA

# Indic_Syllabic_Category=Visarga
113CD      ; Visarga # Mc    TULU-TIGALARI SIGN VISARGA

# Indic_Syllabic_Category=Avagraha
113B7      ; Avagraha # Lo   TULU-TIGALARI SIGN AVAGRAHA

# Indic_Syllabic_Category=Pure_Killer
113CE..113CF ; Virama # Mn   [2] TULU-TIGALARI SIGN VIRAMA..TULU-TIGALARI SIGN LOOPED VIRAMA

# Indic_Syllabic_Category=Invisible_Stacker
113D0      ; Invisible_Stacker # Mn TULU-TIGALARI JOINER

# Indic_Syllabic_Category=Vowel_Independent
11380..11389 ; Vowel_Independent # Lo [10] TULU-TIGALARI LETTER A..TULU-TIGALARI LETTER VOCALIC LL
1138B      ; Vowel_Independent # Lo      TULU-TIGALARI LETTER EE
1138E      ; Vowel_Independent # Lo      TULU-TIGALARI LETTER AI
11390..11391 ; Vowel_Independent # Lo [2] TULU-TIGALARI LETTER OO..TULU-TIGALARI LETTER VOCALIC AU

# Indic_Syllabic_Category=Vowel_Dependent
113B8..113C0 ; Vowel_Dependent # Mc [9] TULU-TIGALARI VOWEL SIGN AA..TIGALARI VOWEL SIGN VOCALIC LL
113C2      ; Vowel_Dependent # Mn      TIGALARI VOWEL SIGN EE
113C5      ; Vowel_Dependent # Mn      TIGALARI VOWEL SIGN AI
113C7..113C9 ; Vowel_Dependent # Mc [3] TIGALARI VOWEL SIGN OO..TIGALARI VOWEL AU LENGTH MARK

```

```

# Indic_Syllabic_Category=Consonant
11392..113B5 ; Consonant # Lo [36] TULU-TIGALARI LETTER KA..TULU-TIGALARI LETTER LLLA

# Indic_Syllabic_Category=Cantillation_Mark
113E1..113E2 ; Cantillation_Mark # Mn [2] TULU-TIGALARI VEDIC TONE SVARITA..TULU-TIGALARI VEDIC TONE ANUDATTA

# Indic_Syllabic_Category=Consonant_Preceding_Repha
113D1 ; Consonant_Preceding_Repha # Lo TULU-TIGALARI REPHA

# Indic_Syllabic_Category=Syllable_Modifier
113D3 ; Syllable_Modifier # Mc TULU-TIGALARI SIGN TIDDU

```

10.4 Indic Positional Category

```

# Indic_Positional_Category=Right
113B8..113BA ; Right # Mc [3] TULU-TIGALARI VOWEL SIGN AA..TULU-TIGALARI VOWEL SIGN II
113C9..113CA ; Right # Mc [2] TULU-TIGALARI AU LENGTH MARK..TULU-TIGALARI SIGN CANDRA ANUNASIKA
113CC..113CD ; Right # Mc [2] TULU-TIGALARI SIGN ANUSVARA..TULU-TIGALARI SIGN VISARGA
113CF ; Right # Mc TULU-TIGALARI SIGN LOOPED VIRAMA

# Indic_Positional_Category=Left
113C2 ; Left # Mc TULU-TIGALARI VOWEL SIGN EE
113C5 ; Left # Mc TULU-TIGALARI VOWEL SIGN AI

# Indic_Positional_Category=Left_And_Right
113C7..113C8 ; Left_And_Right # Mc [2] TULU-TIGALARI VOWEL SIGN OO..TULU-TIGALARI VOWEL SIGN AU

# Indic_Positional_Category=Top
113CE ; Top # Mn TULU-TIGALARI SIGN VIRAMA
113D1 ; Top # Mn TULU-TIGALARI REPHA
113E1..113E2 ; Top # Mn [2] TULU-TIGALARI VEDIC TONE SVARITA.. TULU-TIGALARI VEDIC TONE ANUDATTA

# Indic_Positional_Category=Bottom
113BB..113C0 ; Bottom # Mn [6] TULU-TIGALARI VOWEL SIGN U..TULU-TIGALARI VOWEL SIGN VOCALIC LL

```

11 Similar characters (Confusables)

Tulu-Tigalari script has a few characters that look similar to each other. All efforts have been made to make them as unambiguous as possible while not straying away from the original script. However, some characters might still create confusion in their hand-written forms.

Key : Tulu-Tigalari (Ti.), Kannada (Ka.)

1.-		2.-		3.-	
KHA	ᳵ / ᳶ	E	᳚	TA	᳞
CA	᳚	BHA	᳞	NA	᳞
PA	᳞	HA	᳞		
VA	᳞	8 (Ti.)	᳞		
MA	᳞				
4.-		5.-		6.-	
DHA	᳚/3	SHA	᳚	2 (Ti.)	᳚
3	3	GA	᳞	U	᳚
				2	2
7.-		8.-		9.-	
TTA	᳚	Anuswara	᳚	Virama	᳚
Anudatta	᳚	᳚	᳚	Anunasika	᳚ ᳚
		᳚ (Ti.)	᳚	Repha + Virama	᳚
10.-		11.-		12.-	
Vocalic R	᳚	7 (Ti.)	᳚	10 (Ti.)	᳚
4 (Kan.)	᳚	EE-v.s.	᳚	DA	᳚
				DDA	᳚/ ᳚
13.-		14.-			
3 (Ti.)	᳚	GA+Virama	᳚		
I	᳚	SHA+Repha	᳚		

12 Script Extensions

Kannada digits U+0CE6..U+0CEF should be extended for use with Tulu-Tigalari as indicated under section 7.

Acknowledgements

Several institutions and individuals have helped with this Tulu-Tigalari paper over the years. The authors want to explicitly state that those acknowledged below do not necessarily endorse this paper.

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 Taraprakashana, Bangalore
 Poornaprajna Vidyapeetha, Bangalore
 Oriental Research Institute, Mysore
 Keladi Museum
 Shrii Bannanje Govindacharya
 Dr S R Vighnaraj
 Shrii Ramanath Acharya
 Srinidhi (srinidhi.pinkpetals24@gmail.com)
 Keladi Gunda Jois
 Dr Keladi Venkatesh Jois
 Deborah W Anderson
 Anshuman Pandey
 Liang Hai
 S A Krishnaiah
 Shrii Krishnaraja Bhat
 Dr Girish Dalvi
 Immanuel Suresh
 Cibu C J

Individuals who open-heartedly shared their stories and manuscript collections.

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Appendix

1 Traditional v/s Reformed Tulu-Tigalari Script

The Tulu Sahitya Academy has innovated a reformed variant of the Tulu-Tigalari script. It is one of the many attempts to update the script to suit the phonology of the Tulu language (See also: Supplementary paper and L2/20-177). The academy's attempt also aims to simplify the script behaviour to a large extent by normalizing variants.

In fact, this reformed script borrows many of the same principles adopted by the reformed Malayalam script that was invented due to constraints in hot-metal printing and typewriters.

- Normalizing the U, UU, VOCALIC R, VOCALIC RR Vowel signs to be uniform and non-ligating. In the traditional script, they usually ligate (and rather inconsistently) and also change shape with the preceding consonant.
- Simplifying the two-part AU vowel sign to right-side only
- Choosing simple stacking-forms over conjoined forms (that are common in the traditional script)

	Traditional Malayalam	Reformed Malayalam	Traditional Tulu-Tigalari	Reformed Tulu-Tigalari
<i>ku</i> <i>tu</i>	കു തു	കു തു	കു / ക തു / ത	കു തു
<i>kū</i> <i>tū</i>	കൂ തൂ	കു തു	കു തു	കു തു
<i>kr</i> <i>tr</i>	കൃ തൃ	കു തു	കൃ തൃ	കു തു
<i>kau</i> <i>tau</i>	കൌ തൌ	കൗ തൗ	കൌ തൌ	കൗ തൗ
<i>kku</i> <i>ktu</i>	കക കത	കു കു	കക കത	കു കു

Traditional/Reformed Malayalam v/s Traditional/Reformed Tulu-Tigalari

Similar to that of the reformed Malayalam and traditional Malayalam sharing the same encoding, the reformed script proposed by the Tulu Sahitya Academy can be comfortably expressed using a common Tulu-Tigalari code block. Essentially, they are the same script and need to be handled by the same encoding.

The academy has also introduced many “invented” forms to represent vowels (distinguishing long/short /e/, /o/ and new characters for short/long /ae/) that cannot be sufficiently expressed with the traditional script. Many of the forms have been derived by modifying the shape of the traditional vowel sign EE (Refer Figure 11 in the supplementary paper, 'Tulu language and Tigalari Script'). However, the shapes and forms of the new characters are not particularly thought through and need a broader discussion among the user community before being accepted at large. Several such proposals for Tulu vowels have been attempted by various people and there is currently no consensus over which forms to use (particularly for distinguishing long and short /e/ and /o/).

This document has reserved spaces for these innovations. We are of the opinion that these new characters should only be encoded after sufficient consensus has been reached within a wider circle and, after they have acquired sufficient common usage.

Figures



FIGURE 1.

Initials: PU (*Danda*) RA (stands for Puttige Ramakrishna), written on a copper vessel.

SOURCE

Private collection, Udupi District.



FIGURE 2.

Stone inscriptions in Tulu-Tigalari script from Kodipadi Janardana Temple, Puttur Taluk.

SOURCE

Kodipay Janardhana Temple, Mangalore district.

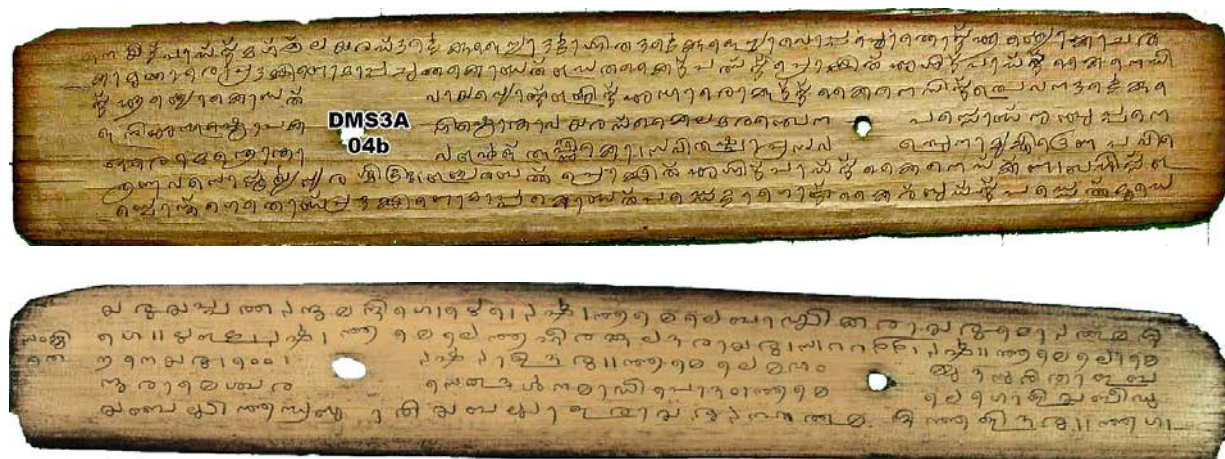


FIGURE 3.

Tulu-Tigalari script, Tulu language (top) and Kannada language (bottom) manuscripts.

SOURCE

(Top) Punyahavidhi, Govind Pai Research Centre, Udupi. (Bottom) Srinidhi A

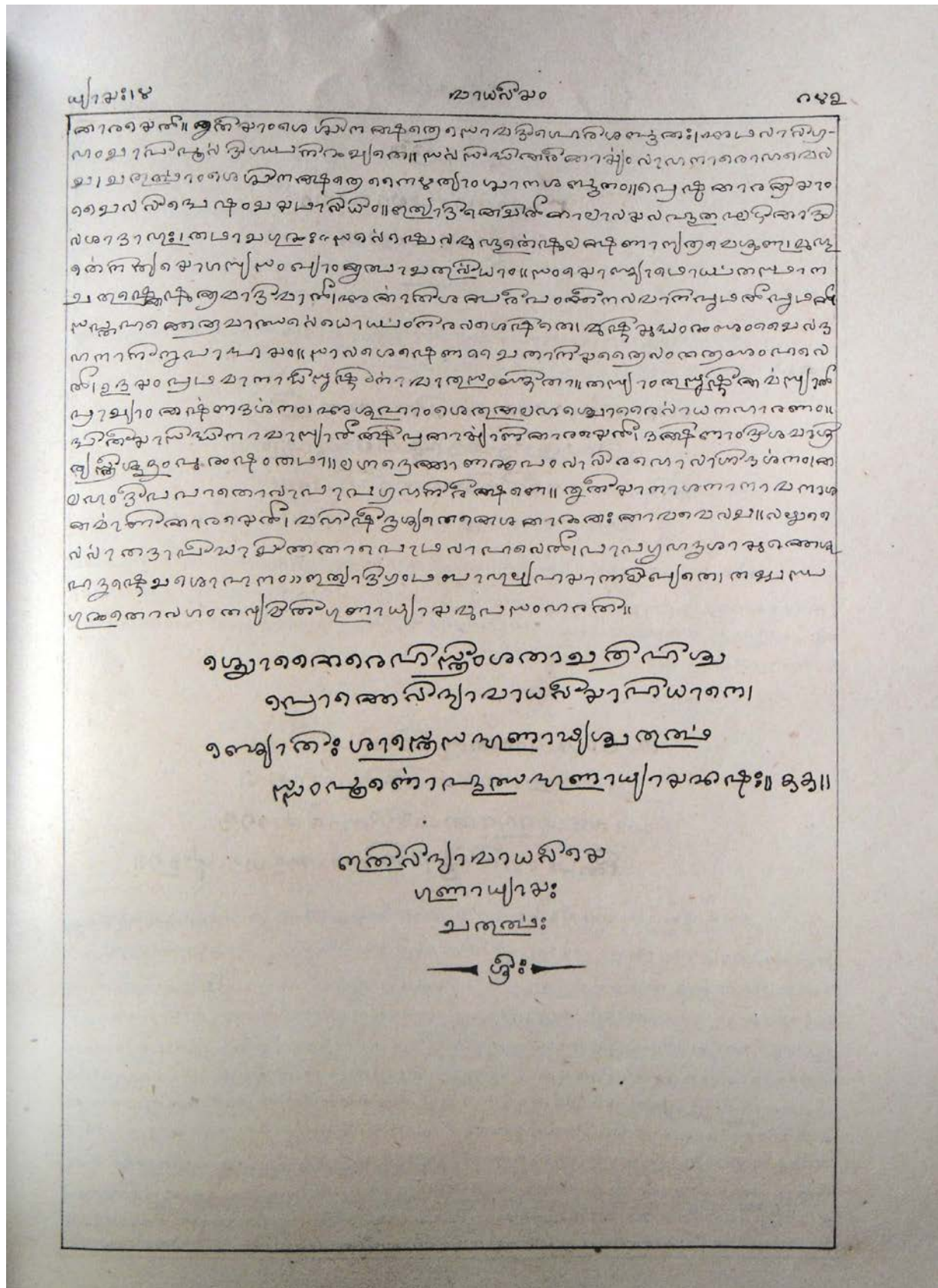
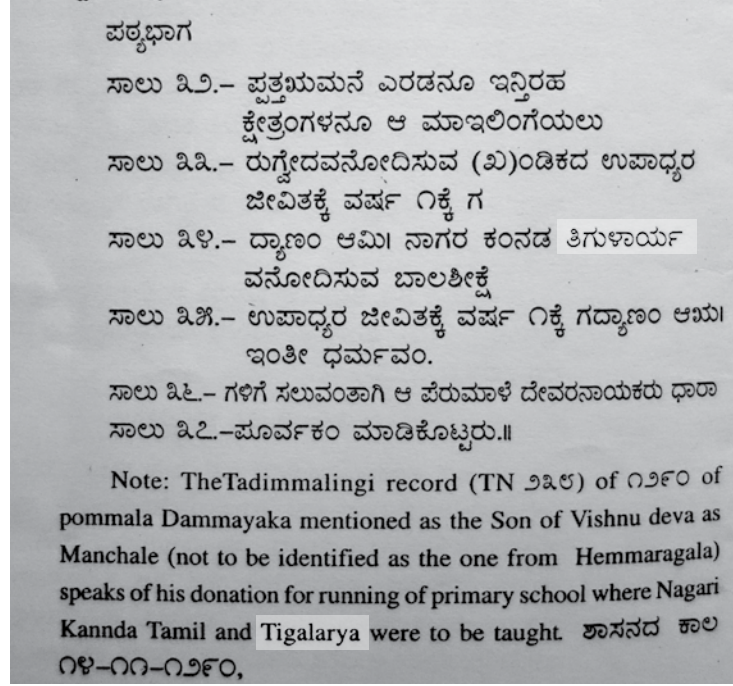


FIGURE 4.
A 20th century paper manuscript in Tulu-Tigalari script.

SOURCE

Dharmasthala Samshodana Pratishthana, Dharmasthala. Handwritten on machine-made paper.



The college founded and endowed in 1290 by the Hoysala minister Perumāla at Māilangi (TN 27) deserves mention, though it was a private rather than a State institution. Provision was made in it for masters to teach Nāgara, Kannaḍa, Tigula (Tamil) and Ārya (Mahratti). Then the Vijayanagar

FIGURE 5.

Gunda Jois mentions an epigraphical reading from a stone inscription dated 14th November 1290 uses the term 'Tigalarya' to refer to the Tulu-Tigalari script (above). However, on examining the primary source by B L Rice (below), one finds the term 'Tigalarya' referred to here is more likely the Tamil Grantha Script as the inscription belonged to a region where only Tamil Grantha and not Tulu-Tigalari script was used.

SOURCE

Jois, Gunda. '*Havyaka Guudhalipi Tigalari Hasthaprathi Granthagalu*' Ananta Krishna Carita. 114. Print.

PRIMARY SOURCE

(Ctsy. Srinidhi A) "Inscription No.: TN. 27." Epigraphia Carnatica, by B. Lewis Rice, vol. 3, Mysore Govt. Central Press, 1886, pp. 216–217. (http://idb.ub.uni-tuebingen.de/opendigi/EC_03_1894_B)

	Tamil	Grantha	Tulu-Tigalari	Malayalam	Kannada
ANUSVARA	-	ಂ	ಂ	ಂ	ಂ
VISARGA	-	ಃ	ಃ	ಃ	ಃ
LETTER A	அ	𑌀	𑌀	അ	ಅ
LETTER AA	ஆ	𑌁	𑌁	ആ	ಆ
LETTER I	இ	𑌂	𑌂	ഇ	ಇ
LETTER II	ஈ	𑌃	𑌃	ഈ	ಈ
LETTER U	உ	𑌄	𑌄	ഉ	ಉ
LETTER UU	ஊ	𑌅	𑌅	ഊ	ಊ
LETTER VOCALIC R	-	𑌆	𑌆	ഋ	ಋ
LETTER VOCALIC RR	-	𑌇	𑌇	ೠ	ೠ
LETTER VOCALIC L	-	𑌈	𑌈	ൠ	ೡ
LETTER VOCALIC LL	-	𑌉	𑌉	ൡ	ೢ
LETTER E	எ	(ಎಂ ?)	(ೇ ?)	എ	ಎ
LETTER EE	ஏ	ಎಂ	𑌊	ഈ	ಏ
LETTER AI	ஐ	𑌊	𑌊	ഐ	ಐ
LETTER O	ஓ	(ொ ?)	(ೋ ?)	ഒ	ಒ
LETTER OO	ஔ	𑌋	𑌋	ഓ	ಓ
LETTER AU	ஔ	𑌌	𑌌	ഔ	ಔ
LETTER KA	க	𑌍	𑌍	ക	ಕ
LETTER KHA	-	𑌎	𑌎	ഖ	ಖ
LETTER GA	-	𑌏	𑌏	ഗ	ಗ
LETTER GH	-	𑌐	𑌐	ഘ	ಘ
LETTER NG	ங	𑌑	𑌑	ങ	ಙ
LETTER CA	ச	𑌒	𑌒	ച	ಚ
LETTER CHA	-	𑌓	𑌓	ഛ	ಛ
LETTER JA	ஜ	𑌔	𑌔	ജ	ಜ
LETTER JHA	-	𑌕	𑌕	ഝ	ಝ
LETTER NYA	ஞ	𑌖	𑌖	ഞ	ಞ
LETTER TTA	ட	𑌗	𑌗	ട	ಟ

LETTER TTHA	-	஠	஡	஢	ண
LETTER DDA	-	஡	஢	ண	த
LETTER DDHA	-	஢	ண	த	஥
LETTER NNA	ண	ண	ள	ள	ஞ
LETTER TA	த	த	த	த	த
LETTER THA	-	த	த	த	த
LETTER DA	-	த	த	த	த
LETTER DHHA	-	த	த	த	த
LETTER NA	ந	ந	ந	ந	ந
LETTER PA	ப	ப	ப	ப	ப
LETTER PHA	-	ப	ப	ப	ப
LETTER BA	-	ப	ப	ப	ப
LETTER BHA	-	ப	ப	ப	ப
LETTER MA	ம	ம	ம	ம	ம
LETTER YA	ய	ய	ய	ய	ய
LETTER RA	ர	ர	ர	ர	ர
LETTER RRA	ற	ற	ற	ற	ற
LETTER LA	ல	ல	ல	ல	ல
LETTER LLA	ள	ள	ள	ள	ள
LETTER LLLA	ழ	ழ	ழ	ழ	ழ
LETTER VA	வ	வ	வ	வ	வ
LETTER SHA	ஸ	ஸ	ஸ	ஸ	ஸ
LETTER SSA	ஷ	ஷ	ஷ	ஷ	ஷ
LETTER SA	ஸ	ஸ	ஸ	ஸ	ஸ
LETTER HA	ஹ	ஹ	ஹ	ஹ	ஹ
VOWEL SIGN AA	ஶ	ஶ	ஶ	ஶ	ஶ
VOWEL SIGN I	ி	ி	ி	ி	ி
VOWEL SIGN II	ீ	ீ	ீ	ீ	ீ
VOWEL SIGN U	ூ	ூ	ூ	ூ	ூ
VOWEL SIGN UU	ூ	ூ	ூ	ூ	ூ

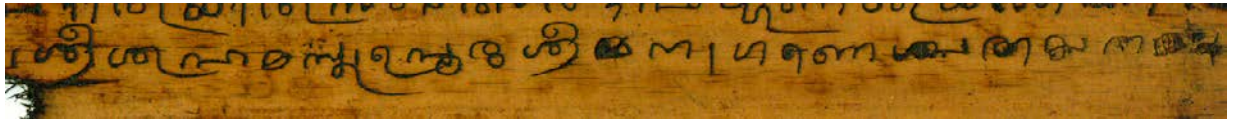
VOWEL SIGN VOCALIC R	-	ꣳ	ꣴ	ꣵ	ꣶ
VOWEL SIGN VOCALIC RR	-	ꣷ	꣸	꣹	꣺
VOWEL SIGN VOCALIC L	-	ꣻ	꣼	ꣽ	ꣾ
VOWEL SIGN VOCALIC LL	-	ꣿ	꤀	꤁	꤂
VOWEL SIGN E	ꣳ	ꣴ	ꣵ	ꣶ	ꣷ
VOWEL SIGN EE	꣸	꣹	꣺	ꣻ	꣼
VOWEL SIGN AI	ꣽ	ꣾ	ꣿ	꤀	꤁
VOWEL SIGN O	ꣳ	ꣴ	ꣵ	ꣶ	ꣷ
VOWEL SIGN OO	꣸	꣹	꣺	ꣻ	꣼
VOWEL SIGN AU	ꣽ	ꣾ	ꣿ	꤀	꤁
VIRAMA	ꣳ	ꣴ	ꣵ	ꣶ	ꣷ
AVAGRAHA	-	ꣳ	ꣴ	ꣵ	ꣶ
REPHA	-	ꣳ	ꣴ	ꣵ	ꣶ
0	0	0	0/0	0	0
1	ꣳ	ꣴ	ꣵ/ꣶ	ꣷ	꣸
2	꣹	꣺	ꣻ/꣼	ꣽ	ꣾ
3	ꣿ	꤀	꤁/꤂	꤃	꤄
4	ꣳ	ꣴ	ꣵ/ꣶ	ꣷ	꣸
5	ꣽ	ꣾ	ꣿ/꤀	꤁	꤂
6	ꣳ	ꣴ	ꣵ/ꣶ	ꣷ	꣸
7	꣹	꣺	ꣻ/꣼	ꣽ	ꣾ
8	ꣿ	꤀	꤁/꤂	꤃	꤄
9	ꣳ	ꣴ	ꣵ/ꣶ	ꣷ	꣸
10	꣹	꣺	ꣻ/꣼	ꣽ	ꣾ
100	ꣿ	꤀	꤁/꤂	꤃	꤄

FIGURE 6.

Comparison of Tamil, Grantha, Tulu-Tigalari, Malayalam and Kannada scripts.

Fonts used

Tamil : Noto Sans Tamil, Grantha : e-Grantamil 7, Tulu-Tigalari : Mokay (Designed by the Author),
 Malayalam : Meera, Kannada : Baloo Tamma



ಶ್ರೀ ಶು ಭ ಮ ಸ್ತು | ಉ ಪು ರು ಶ್ರೀ ಮ ಹಾ ಗ ನೇ ಶ್ವ ರಾ ಯ ನ ಮಃ |
 ಶ್ರೀ ಶು ಭ ಮ ಸ್ತು | ಉ ಪು ರು ಶ್ರೀ ಮ ಹಾ ಗ ನೇ ಶ್ವ ರಾ ಯ ನ ಮಃ |
 ಶ್ರೀ ಶು ಭ ಮ ಸ್ತು | ಉ ಪು ರು ಶ್ರೀ ಮ ಹಾ ಗ ನೇ ಶ್ವ ರಾ ಯ ನ ಮಃ |
 Shri Shu Bha Ma Stu . U Puu Ru Shri Ma Haa Ga Nnee Shva Raa Ya Na Maha.

FIGURE 7.

Transcribing Tulu-Tigalari characters into Kannada, Devanagari and Latin scripts from a manuscript source.

SOURCE

Dodmane. Uppoor. Udupi.



FIGURE 8.1.

Kannada language, Tulu-Tigalari script manuscript.

SOURCE

Yajnavalkya Vyavaharadhiyaya, Srinidhi

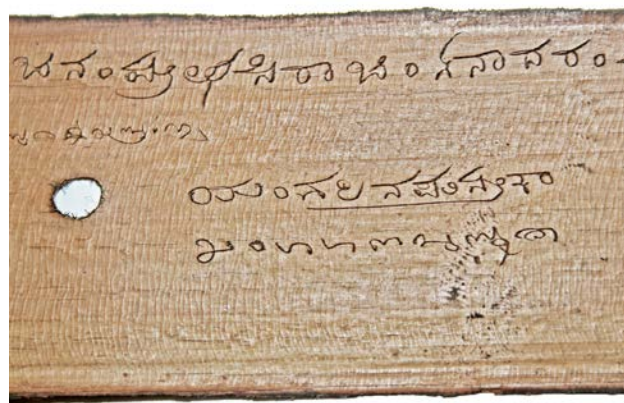
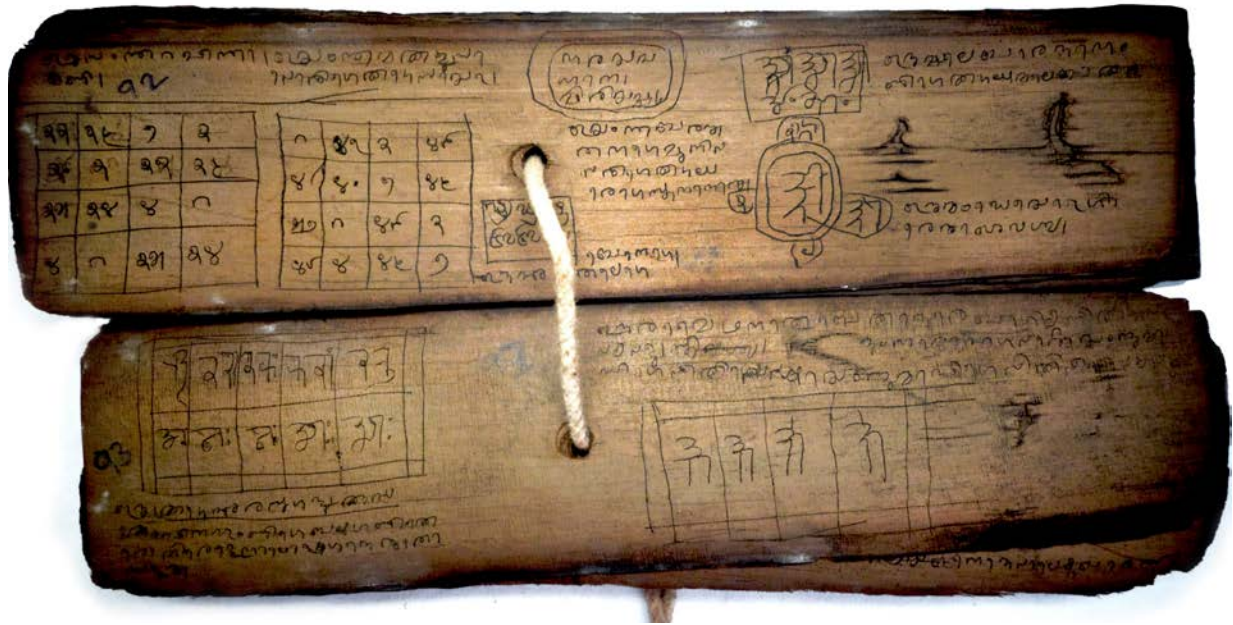


FIGURE 8.2.

A sample of both Kannada and Tulu-Tigalari scripts used on the same leaf of a manuscript. Its common to see Kannada or Nandinagari scripts used in the last few pages of the Tulu-Tigalari manuscripts.

SOURCE

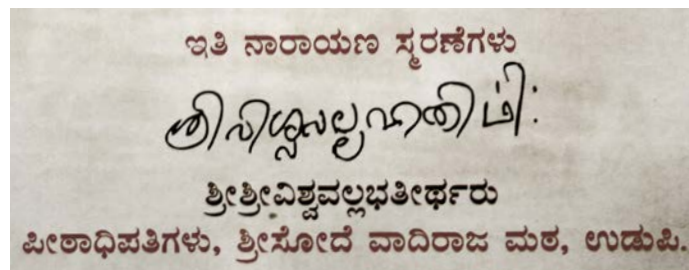
Yajnavalkya Vyavaharadhiyaya, Srinidhi

**FIGURE 8.3.**

A tantric plam leaf manuscript that has Kannada, Nagari and Tulu-Tigalari scripts.

SOURCE

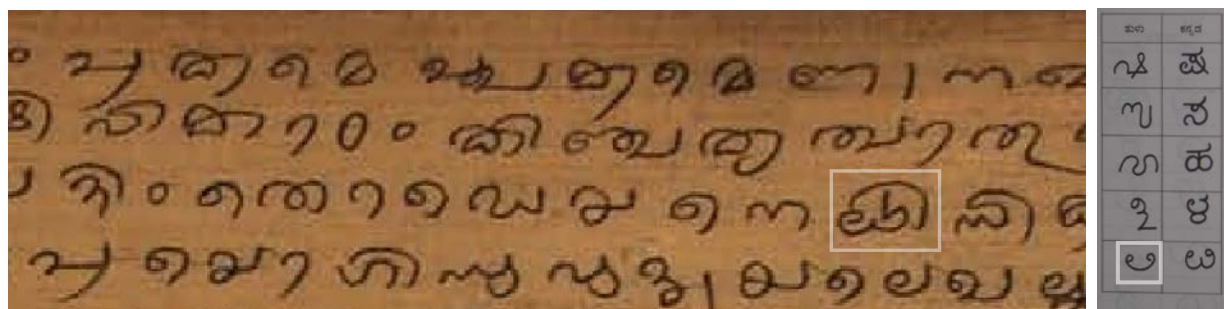
Keladi Museum, Keladi.

**FIGURE 9.**

Signature of a prominent seer from Udupi in Tulu-Tigalari that reads 'Shrii Vishwa Vallabha Teertha' of Sōdé Mutt. Rest of the text surrounding it is in Kannada language and script.

SOURCE

Printed on an invitation card.

**FIGURE 10.****(LEFT)**

RRA+l-v.s found in a Kannada language, Tulu-Tigalari script manuscript. This character has been recently found by Srinidhi in several other such Kannada language manuscripts.

SOURCE

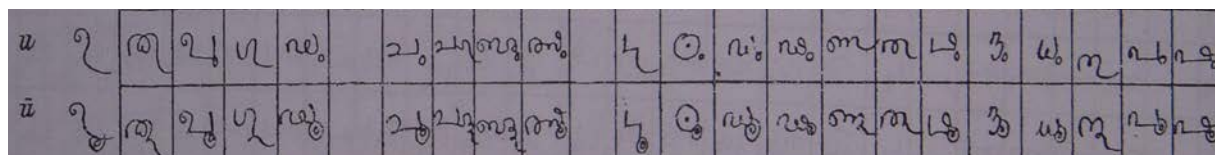
Srinidhi.

(RIGHT)

Tulu-Tigalari letter LLLA as documented by Venkataraja Puninchathaya.

SOURCE

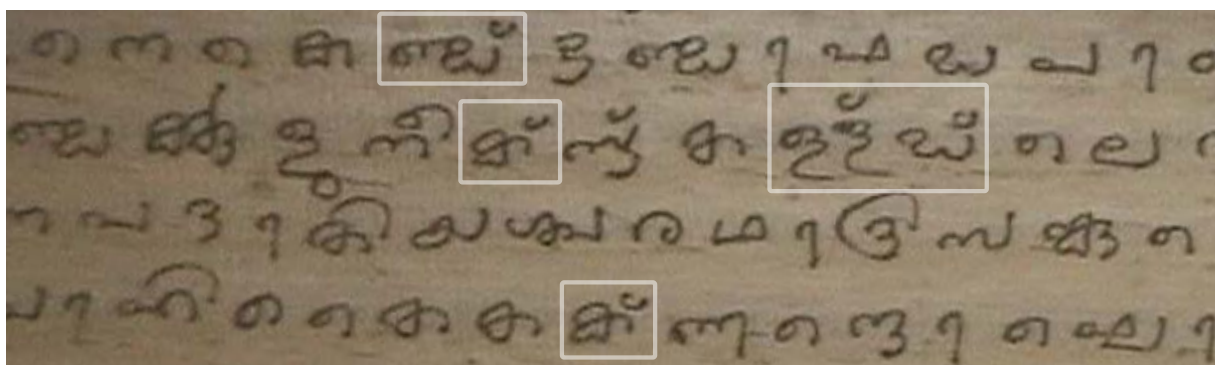
Puninchathaya Venkataraja, Tulu Lipi, Tulu Sahitya Academy, Mangalore.

**FIGURE 11.**

Vowel sign U & UU change according to the character they are combining with.

SOURCE

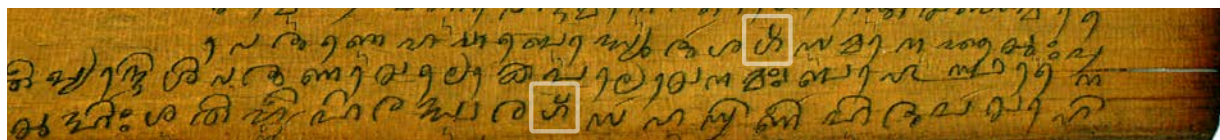
A C Burnell, Elements of South Indian Palaeography

**FIGURE 12.**

A manuscript of Tulu language and Tulu-Tigalari script. Here we see a sequence of letters with *Virama* representing the short un-rounded 'u'.

SOURCE

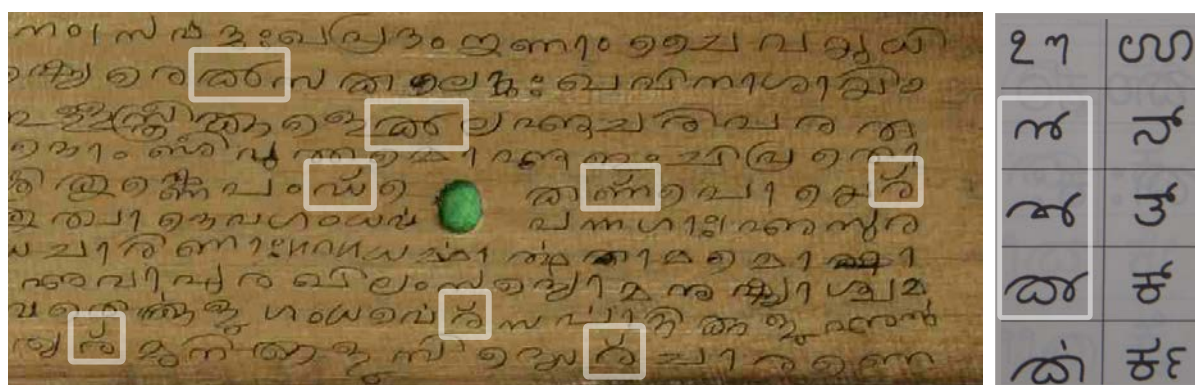
Dharmasthala Samshodana Pratishtana, Dharmasthala.

**FIGURE 13.**

A manuscript of Sanskrit language which uses the semi-circular *Virama* form denoting the negation of the inherent vowel 'A'.

SOURCE

Taraprakashana, Bangalore.

**FIGURE 14.****(LEFT)**

Both the *Virama* forms seen used in a Tulu language, Tulu-Tigalari script manuscript. Note Ra+*Virama* does not form *Repha*. The combining *Virama* indicates a special vowel that is distinct from a *Repha*.

SOURCE

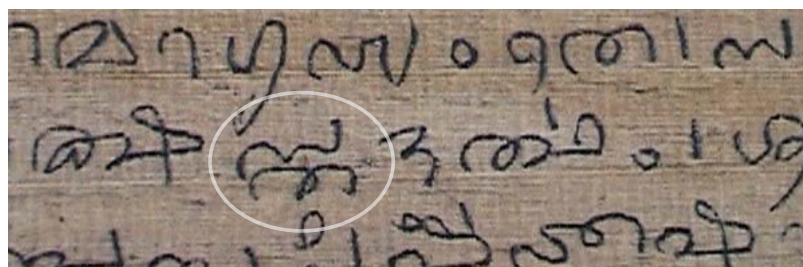
Anantavruta Kathe, S.A.Krishnaiah, Govinda Pai Research Centre, Udupi

(RIGHT)

Virama ligatures in a Tulu-Tigalari script text book.

SOURCE

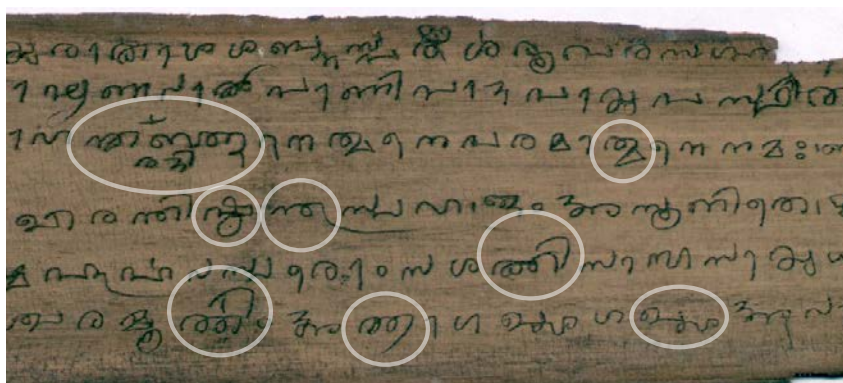
Tulu Sahitya Academy, Mangalore.

**FIGURE 15.**

Here, we can see the common practice of drawing post-base forms the same size as the base consonant. It is also interesting to note that most vertical conjuncts shift slightly above the base-line, reducing the interlinear space.

SOURCE

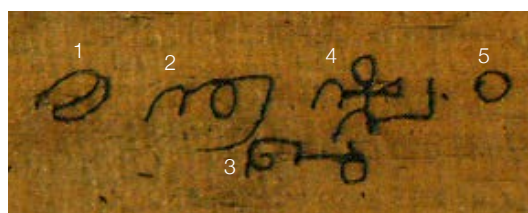
Oriental Research Institute, Mysore.

**FIGURE 16.**

Various forms of ligatures found on a manuscript.

SOURCE

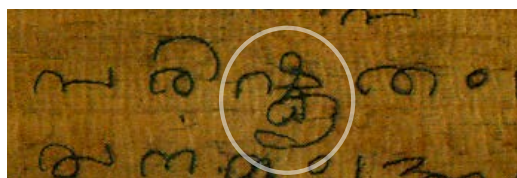
Private collection, Tamil Nadu.

**FIGURE 17.**

1. Consonant MA,
2. Horizontal Conjunct [NTRA = NA+TA+RA],
3. Consonant + Vowel Sign [PU = PA+U(v.s.)],
4. Vertical Conjunct [SSPA = SSA+PA],
5. Anuswara. The word reads *Mantrapushpam*.

SOURCE

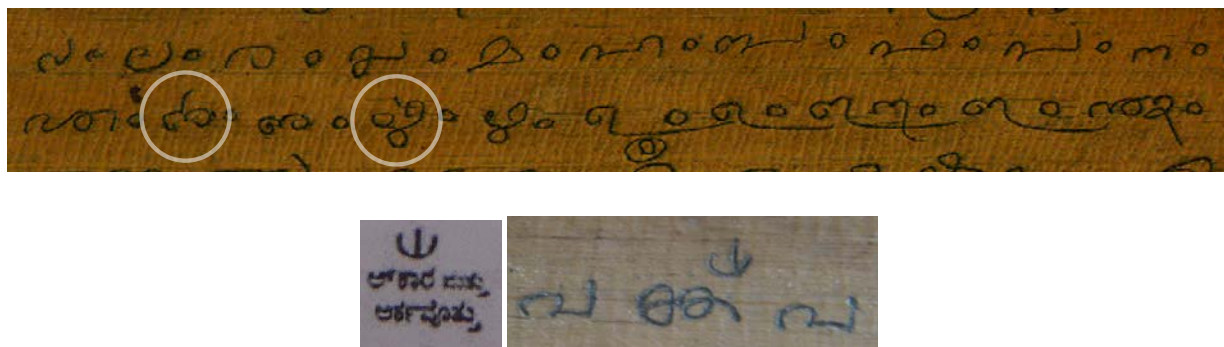
Private Collection, Puttur.

**FIGURE 18.**

An example of Vertical Ligature combining with a vowel sign [SSA+KA+Vocalic R].

SOURCE

Private Collection, Bangalore.

**FIGURE 19.****(ABOVE)**

Vowels Vocalic RR and Vocalic LL are represented with a *Repha*.

SOURCE

Private collection, Udupi.

(BELOW)

Virama and *Repha* ligature.

SOURCE**(LEFT)**

15th century specimen isolated by Dr Venkataraja Puninchathaya.

(RIGHT)

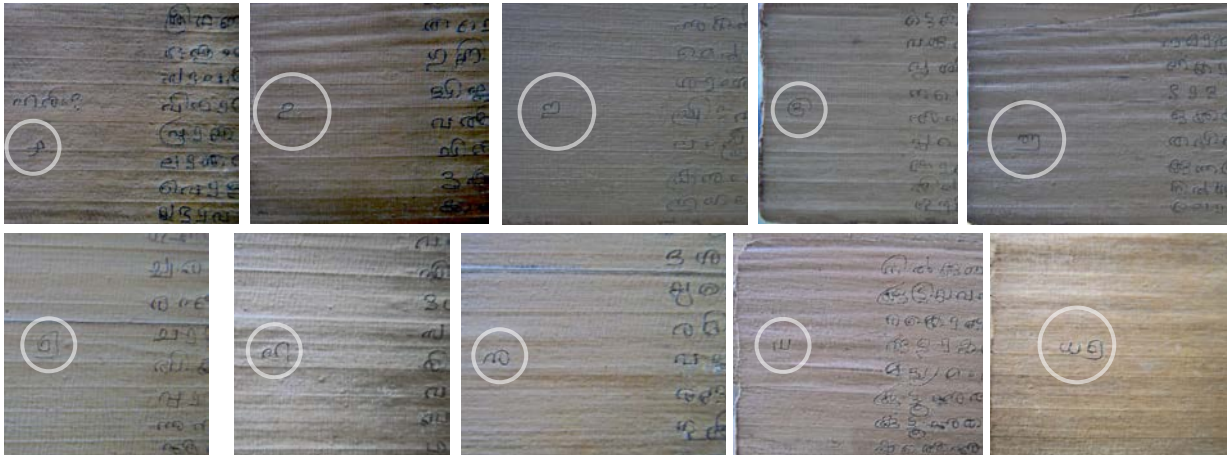
Tulu Ramayana, Dharmasthala Samshodana Pratishtana, Dharmasthala.

**FIGURE 20.**

Telugu-Kanarese numerals are used in most Tulu-Tigalari manuscripts. In the above example, these numbers are seen used to number the pages on a palm leaf manuscript. Its interesting to note however that 5 (arrow indicator) is sometimes written in the above style which is slightly different from the current Telugu-Kannada style.

SOURCE

Private collection. Udupi.

**FIGURE 21.**

'Tulu Numbers' page numbering examples :

1, 2, 3, 5, 6
7, 8, 9, 10, 17

SOURCE

Dharmasthala Samshodana Pratisthana, Dharmasthala.

ತುಳು ಅಕ್ಷರ ಸಂಖ್ಯೆಗಳು									
1 - ೧	11-ಎ೧	21-೨ಎ೧	31-೩ಎ೧	41-೪ಎ೧	51-೫ಎ೧	61-೬ಎ೧	70-೭ಎ೧	81-೮ಎ೧	91-೯ಎ೧
2 - ೨	12-ಎ೨	22-೨ಎ೨	32-೩ಎ೨	42-೪ಎ೨	52-೫ಎ೨	62-೬ಎ೨	72-೭ಎ೨	82-೮ಎ೨	92-೯ಎ೨
3 - ೩	13-ಎ೩	23-೨ಎ೩	33-೩ಎ೩	43-೪ಎ೩	53-೫ಎ೩	63-೬ಎ೩	73-೭ಎ೩	83-೮ಎ೩	93-೯ಎ೩
4 - ೪	14-ಎ೪	24-೨ಎ೪	34-೩ಎ೪	44-೪ಎ೪	54-೫ಎ೪	64-೬ಎ೪	74-೭ಎ೪	84-೮ಎ೪	94-೯ಎ೪
5 - ೫	15-ಎ೫	25-೨ಎ೫	35-೩ಎ೫	45-೪ಎ೫	55-೫ಎ೫	65-೬ಎ೫	75-೭ಎ೫	85-೮ಎ೫	95-೯ಎ೫
6 - ೬	16-ಎ೬	26-೨ಎ೬	36-೩ಎ೬	46-೪ಎ೬	56-೫ಎ೬	66-೬ಎ೬	76-೭ಎ೬	86-೮ಎ೬	96-೯ಎ೬
7 - ೭	17-ಎ೭	27-೨ಎ೭	37-೩ಎ೭	47-೪ಎ೭	57-೫ಎ೭	67-೬ಎ೭	77-೭ಎ೭	87-೮ಎ೭	97-೯ಎ೭
8 - ೮	18-ಎ೮	28-೨ಎ೮	38-೩ಎ೮	48-೪ಎ೮	58-೫ಎ೮	68-೬ಎ೮	78-೭ಎ೮	88-೮ಎ೮	98-೯ಎ೮
9 - ೯	19-ಎ೯	29-೨ಎ೯	39-೩ಎ೯	49-೪ಎ೯	59-೫ಎ೯	69-೬ಎ೯	79-೭ಎ೯	89-೮ಎ೯	99-೯ಎ೯
10 - ೧೦	20-೨ಎ೧೦	30-೩ಎ೧೦	40-೪ಎ೧೦	50-೫ಎ೧೦	60-೬ಎ೧೦	70-೭ಎ೧೦	80-೮ಎ೧೦	90-೯ಎ೧೦	100-೧೦೦

FIGURE 22.

Tulu-Tigalari Number system. The title reads 'Tulu numbers' as its commonly referred to by this name by the scholars of the Tulu speaking region today. These characters are extremely rare and needs further research. They are not proposed as of now.

SOURCE

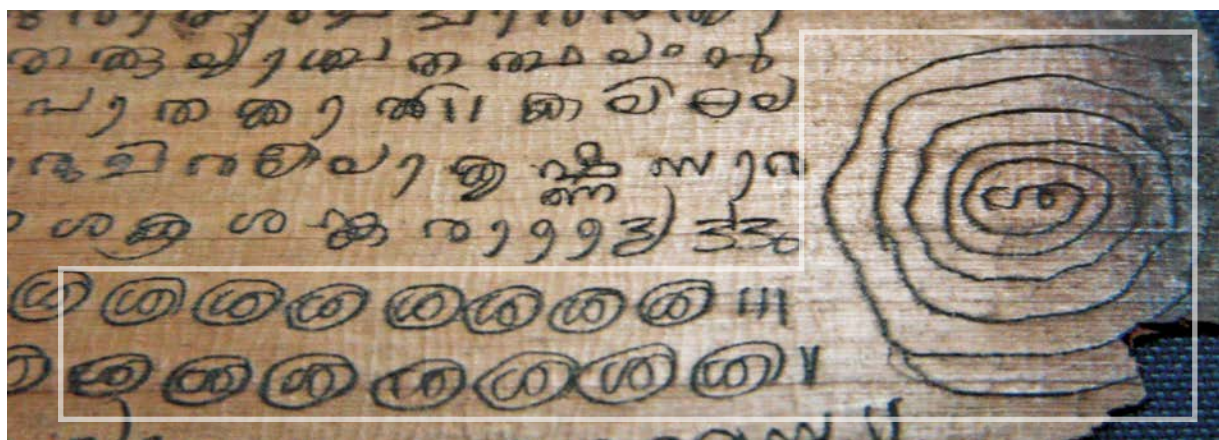
Dr S R Vighnaraj, Dharmasthala Samshodana Pratisthana, Dharmasthala. Published by Tulu Sahitya Academy, Mangalore. 2006.

**FIGURE 23.**

Examples of *Pushpika* 'ೃ'.

SOURCE

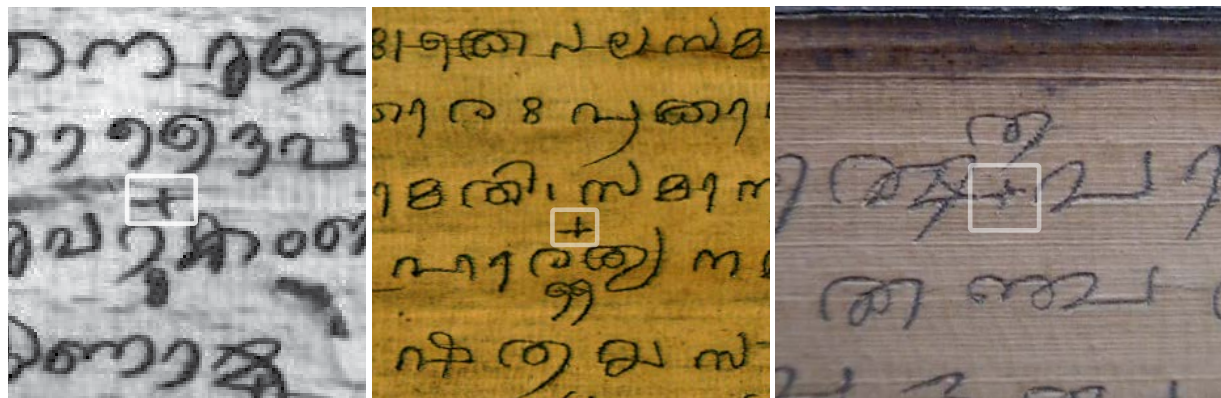
Private collection, Mangalore district.

**FIGURE 24.**

Example of *Shrii* 'ೃ' used as space filler and an ornament.

SOURCE

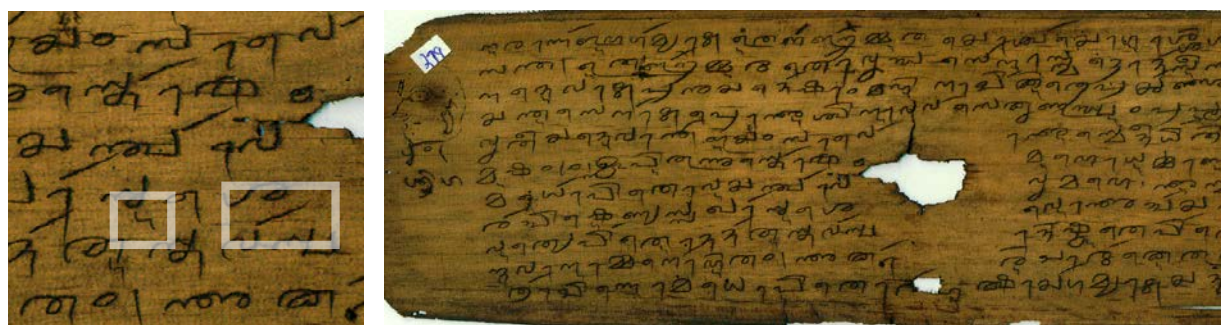
Private collection, Mangalore district.

**FIGURE 25.**

Example of *Tiddu* marks with corrections appearing above and below the baseline.

SOURCE

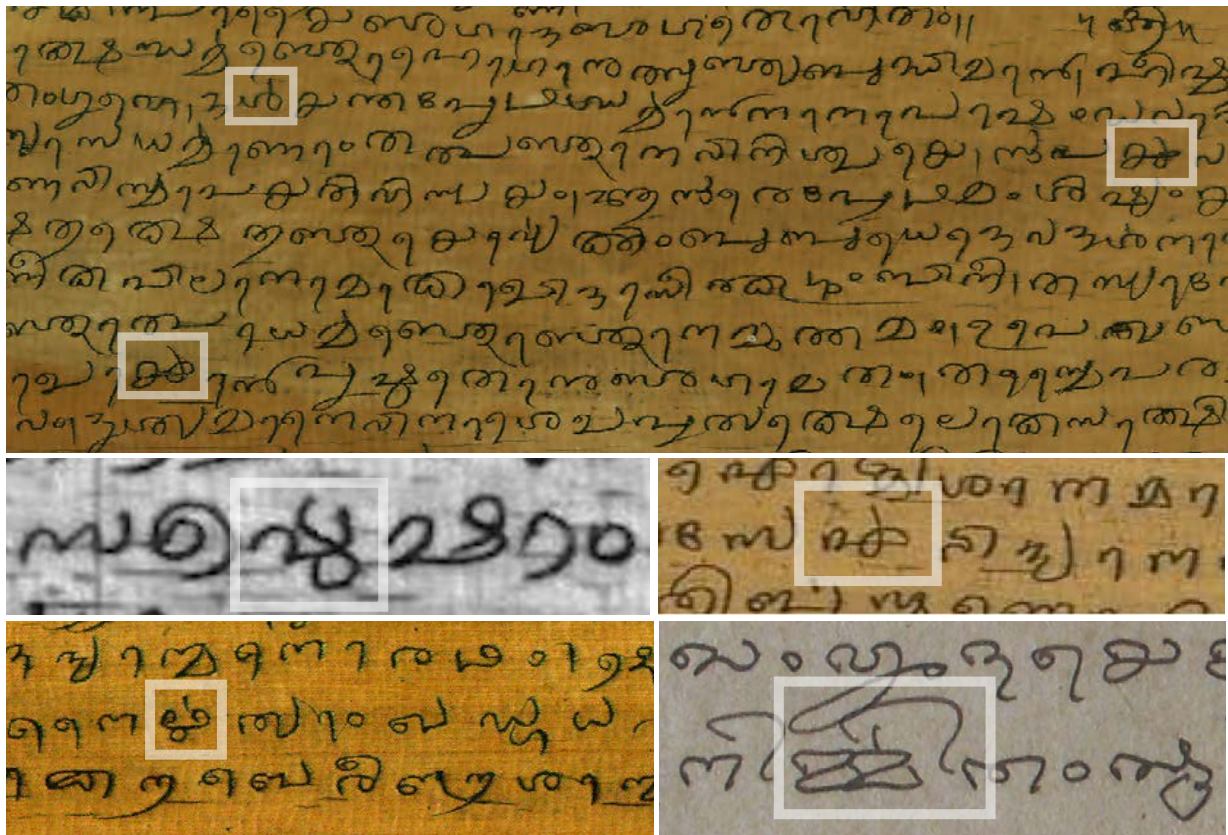
Mahaitarayopanishatt Bhashya, Location: Udupi Mutt. Digitised by Taraprakahana, Bangalore.

**FIGURE 26.**

Svarita (◌̣) and *Anudatta* (◌̣̣) are marked in the close-up of the above manuscript (left). They can be seen used several times across the manuscript page (right).

SOURCE

Private collection, Mangalore district.

**FIGURE 27.****(TOP)**

Ligature form YA+Repha (𑌕). Also note the Tulu-Tigalari Letter SHA forms a ligature with *Repha* here. Not to be confused with a SHA+*Virama chillu* form as seen in Malayalam U+0D7E. Since the occurrence of SHA+Repha ligature is rare, this form is not recommended.

SOURCE

Private Collection, Kasaragod.

(MIDDLE RIGHT AND LEFT)

The two forms of VA+Repha (𑌕 / 𑌖) ligature found in Tulu-Tigalari.

SOURCE

Left : Sarvamoola Grantha, Udupi Mutt. Digitised by Taraprakashana, Bangalore

Right : Srinidhi

(BELOW LEFT)

Repha combining with Vocalic R. From the word NAIRRTYAAM नैर्रत्यां.

SOURCE

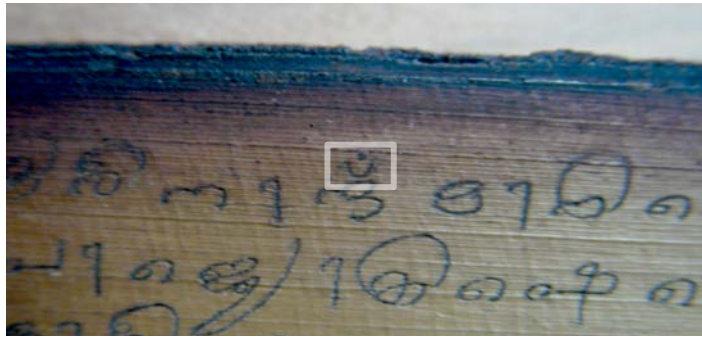
Private Collection, Udupi.

(BELOW RIGHT)

[MA+MA]+Repha+I

SOURCE

Dharmasthala Samshodana Pratishtana, Dharmasthala.

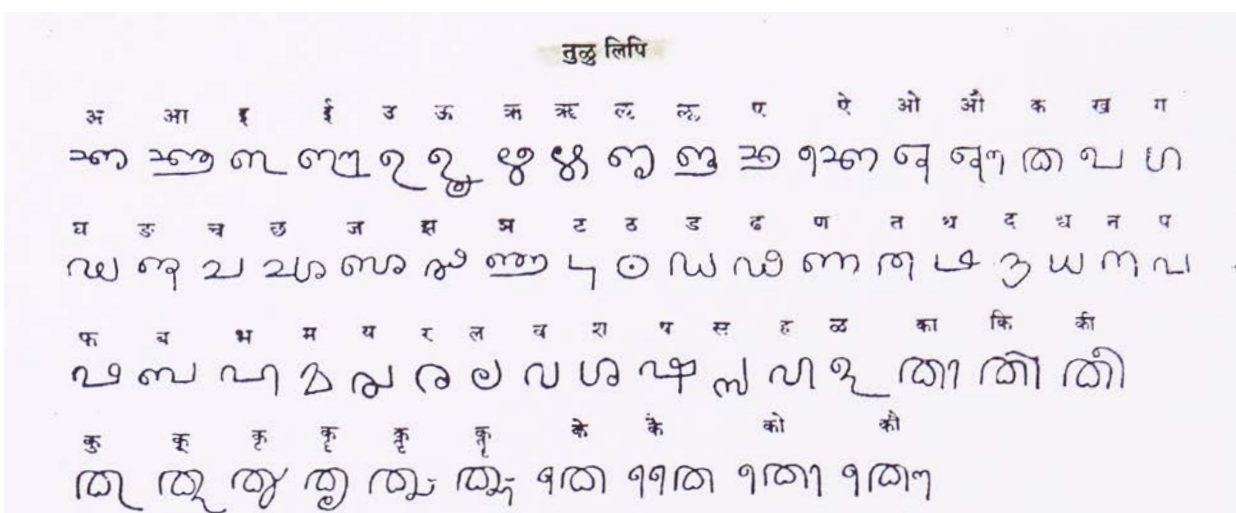
**FIGURE 28.**

Candrabindu style Anunasika character seen used in a Tulu language manuscript. This symbol is used experimentally here in an attempt to indicate the half unrounded U sound which is otherwise associated with a *Candra Virama* form.

SOURCE

Tulu Ramayana, Dharmasthala Samshodana Pratisthana, Dharmasthala.

NOTE — Figures : 29, 30, 31, 32, 33, 34, 35, 36, 37, 42, 43, 44, 44.1, 45 & 46 are samples of the Tulu-Tigalari alphabet from individuals and institutions. There are inconsistencies in several of these figures. The character representations will differ, at times, from what is proposed in this paper. However, it makes for an interesting collection to study the various representations and are therefore included here.

**FIGURE 29.**

Tulu-Tigalari alphabet

SOURCE

Ojha, Gauri Shankar Hirachand. *Bharatiya Prachin Lipimala (The Palaeography of India)*. Delhi : Munshiram Manoharlal, 1918. Print.

൧൯൧൩
 TULU, 19TH CENT.
 ൧൯൧൩

FIGURE 30.

Tulu-Tigalari (Tulu) script as recorded by A C Burnell. (This book has heavily influenced several scholarly works on Tulu-Tigalari.)

SOURCE

Burnell, Arthur Coke. *Elements of South-Indian Palæography, from the Fourth to the Seventeenth Century, A. D.; Being an Introduction to the Study of South-Indian Inscriptions and Mss.*; London: Trübner & [Mangalore, Basel Mission], 1878. Plate XVI. Internet Archive. Web. 31 July 2015.

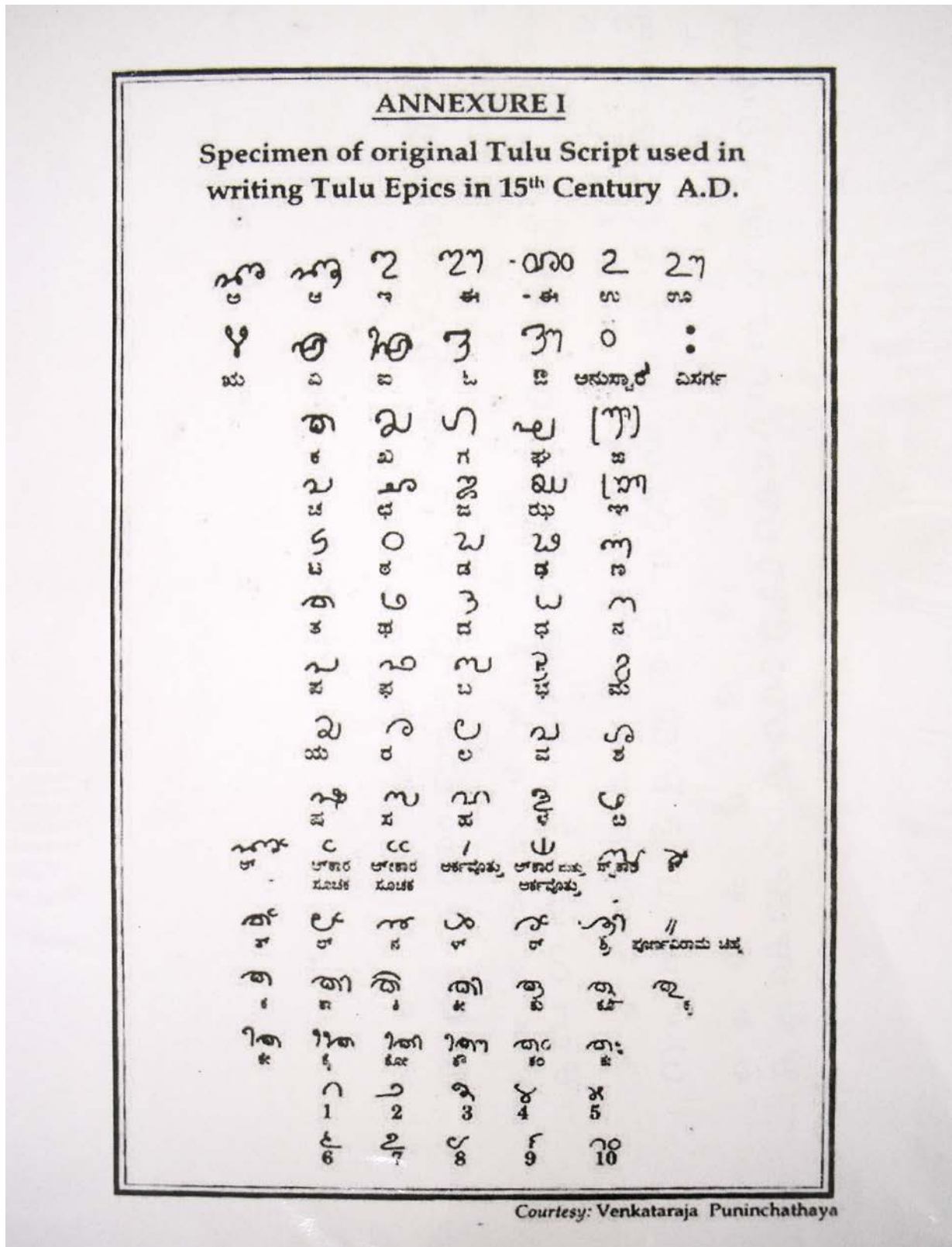


FIGURE 31.

Dr Venkataraja Puninchathaya was one of the early scholars to study this script closely in the recent times. He called this script Tulu script and was also responsible for translating several Tulu-Tigalari script, Tulu language original literature into Kannada. Tulu-Tigalari script taught in schools today by Tulu Sahitya Academy follows his style of writing Tulu-Tigalari.

SOURCE

Venkataraja Puninchathaya, Unknown Publication.

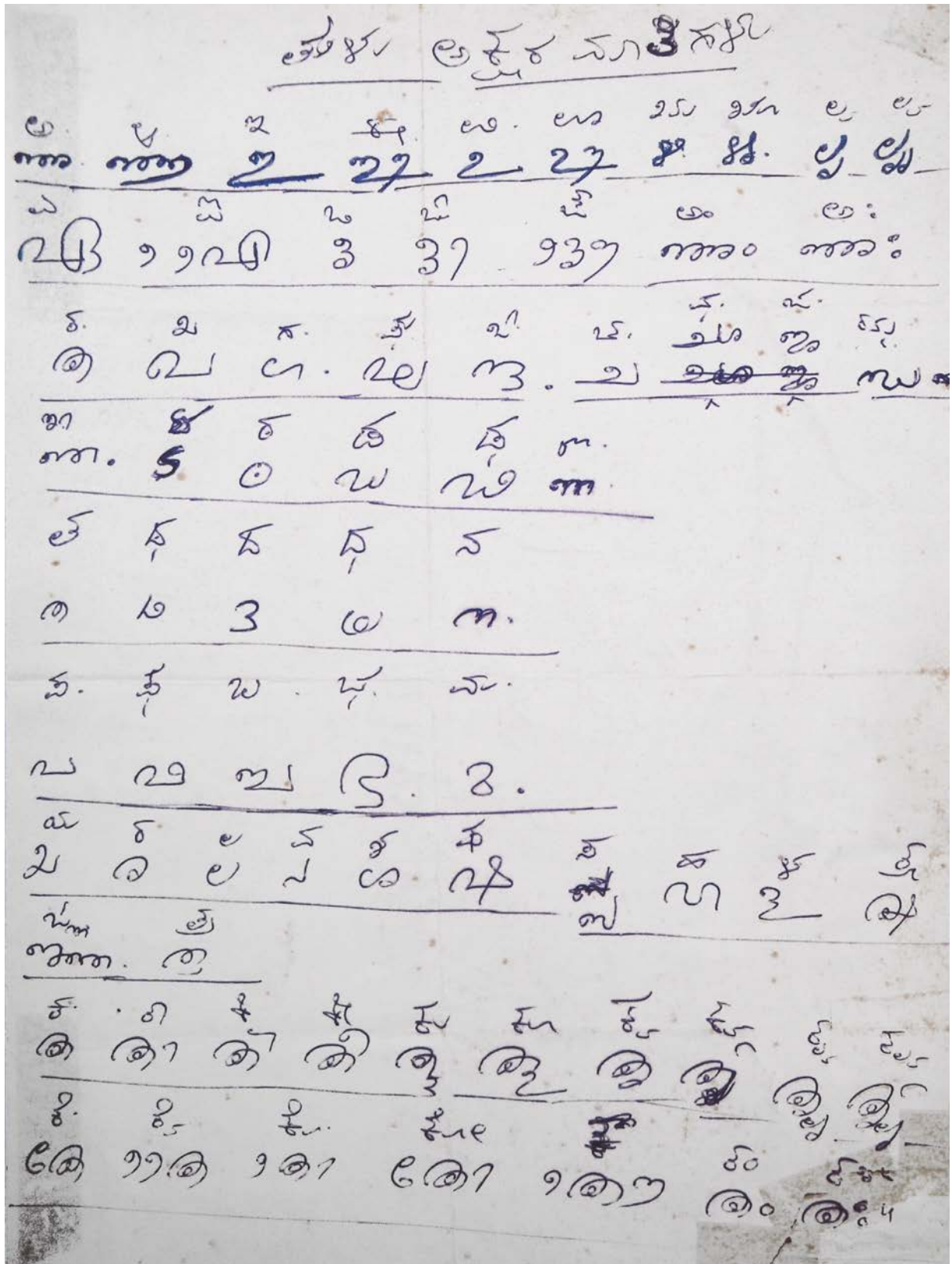
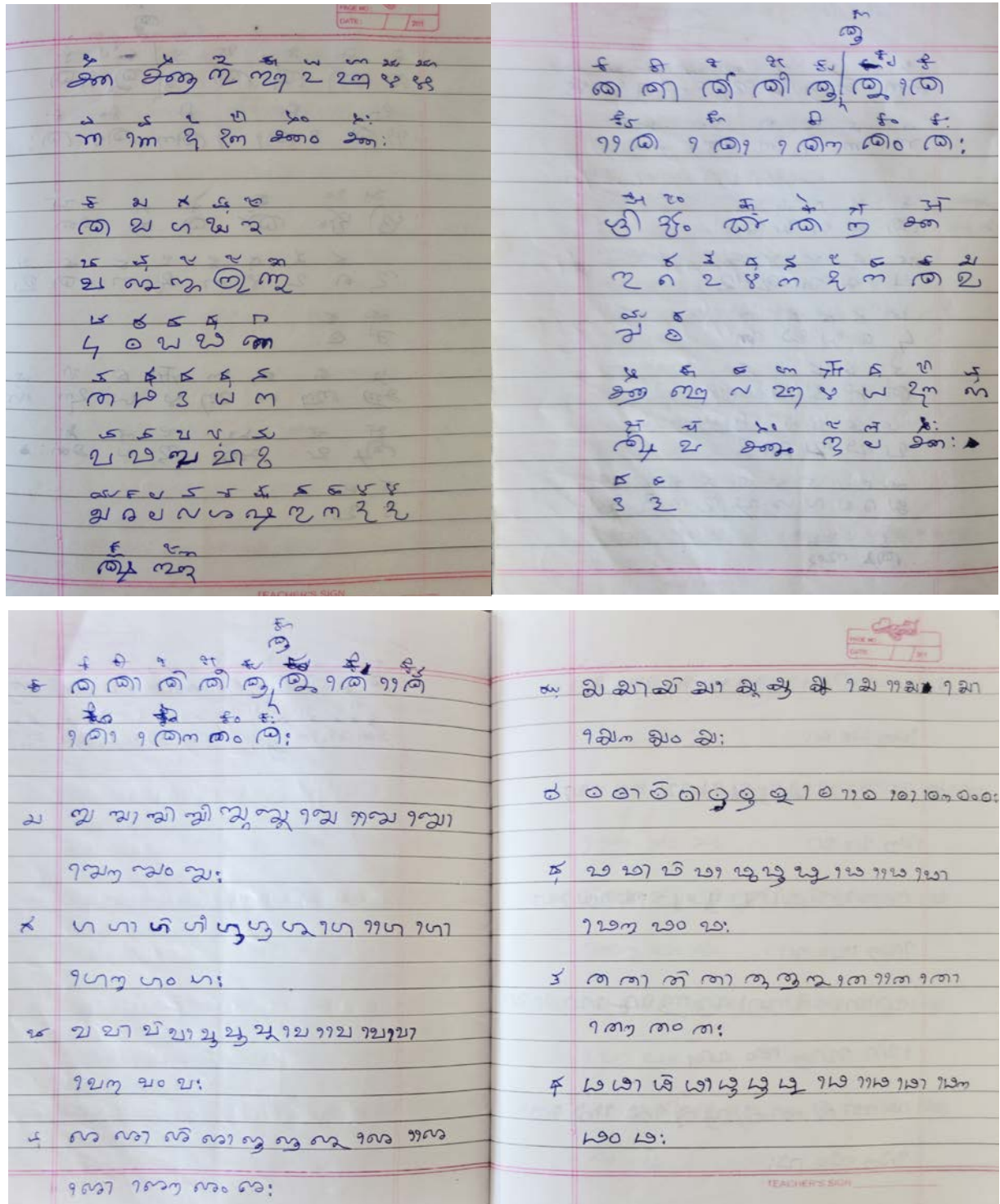


FIGURE 32.

Handwriting Sample of the Tulu-Tigalari character-set and vowel marks.

SOURCE

Poornaprajna Vidyapeetha, Bangalore.

**FIGURE 33.**

Gunda Jois and his son, Venkatesh Jois established a Museum a Keladi that houses several Tigalarai manuscripts. They have studied this script for several years now. Images 33, 34 & 35 capture the Tulu-Tigalari orthography as seen in several manuscripts that were read by them.

SOURCE

From the personal notes of Dr Keladi Venkatesh Jois, Keladi Museum, Keladi.

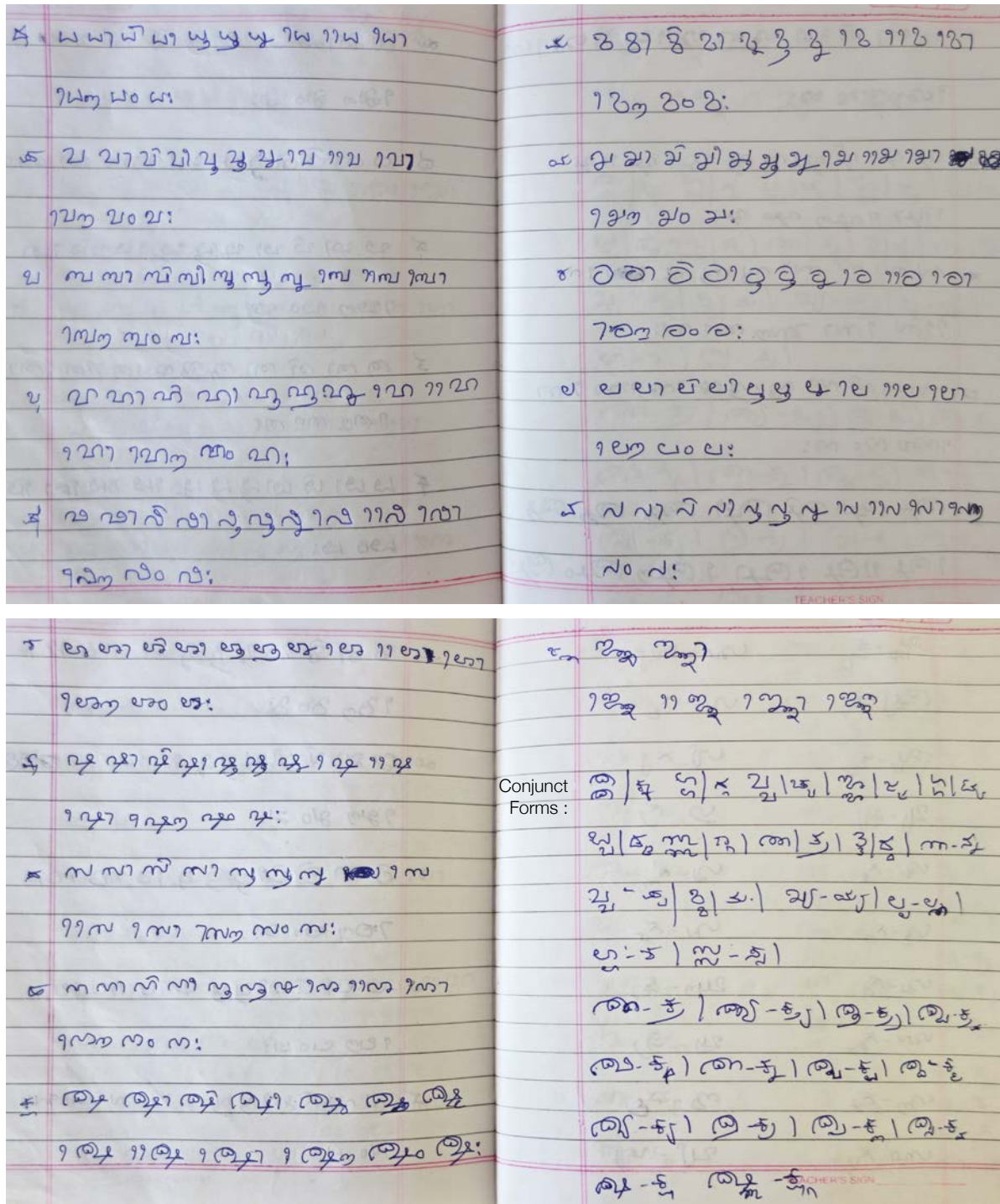
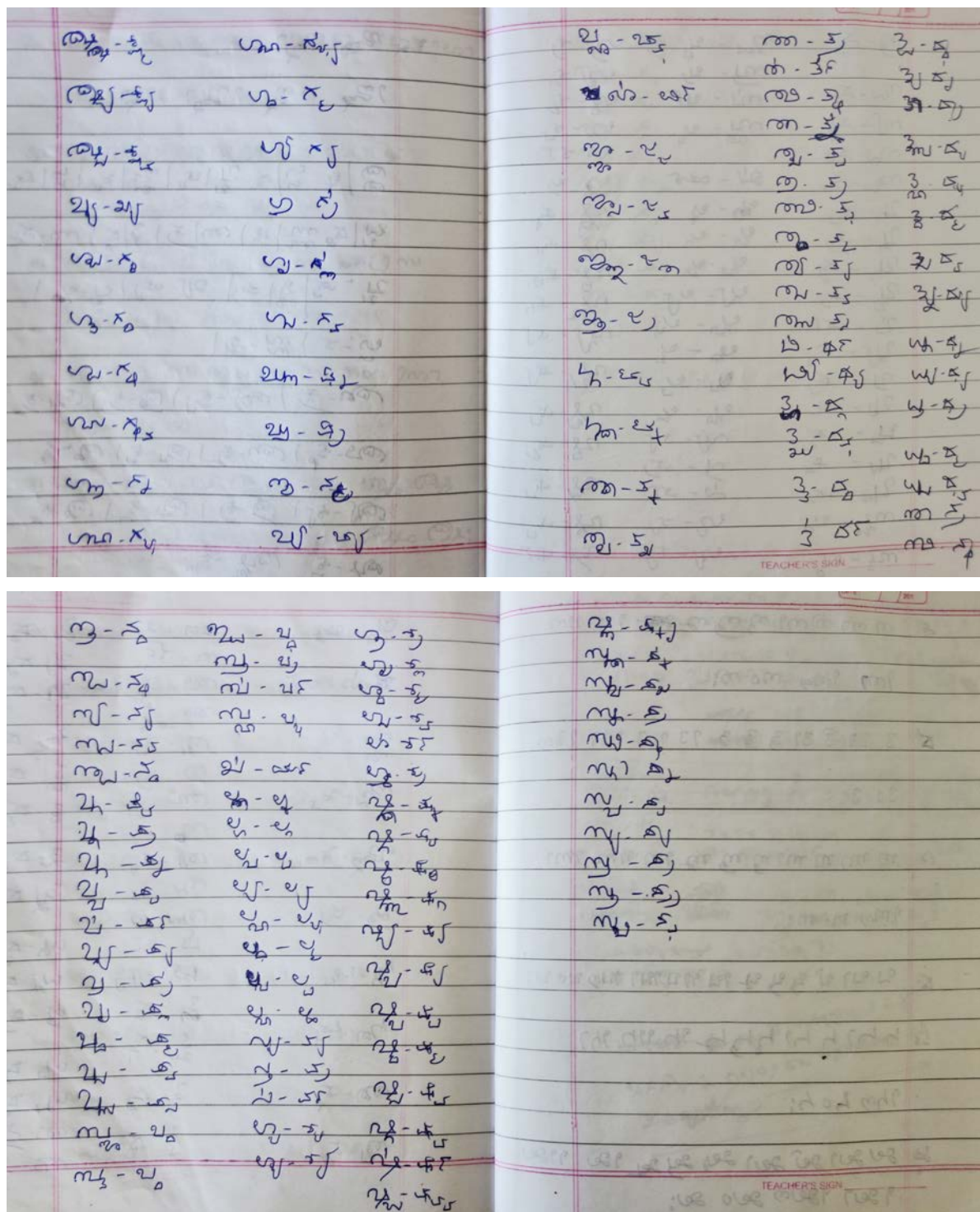


FIGURE 34.

Consonant+Vowel mark combinations and Conjunct forms in Tulu-Tigalari.

SOURCE

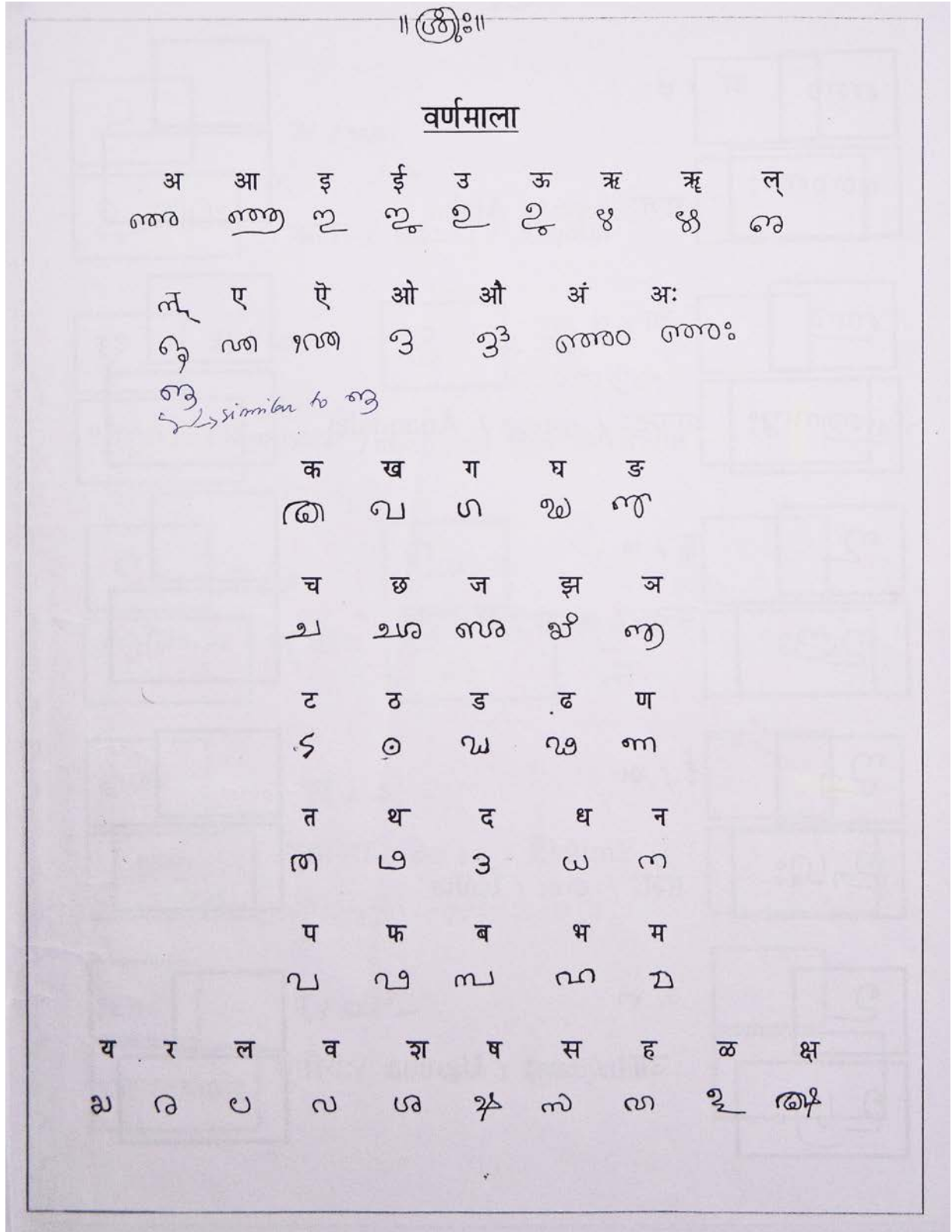
From the personal notes of Dr Keladi Venkatesh Jois, Keladi Museum, Keladi.

**FIGURE 35.**

Listing the conjunct forms in Tulu-Tigalari.

SOURCE

From the personal notes of Dr Keladi Venkatesh Jois, Keladi Museum, Keladi.

**FIGURE 36.**

Tulu-Tigalari script is being taught in several places in Bangalore and coastal Karnataka. The image above is a part of the teaching material used in one of these workshops conducted in Bangalore by *Shrii* Krishnaraja Bhat. His workshops are aimed at teaching this script primarily for Sanskrit language.

SOURCE

The Poornaprajna Samshodhana Mandiram, Bangalore.

॥ (ॐ) ॥

ಅಂಕರಾಣಾಮಿತರಾಣಿ ರೂಪಾಣಿ

ಗುಣಿತಚಿಹ್ನೆ						ಸಂಖ್ಯಾ:	
ಕ	-	ಅ	೨೦೦	ಗ	೫	1	೧೧
ಕಾ	-೧	ಆ	೨೦೧	ಗ	೬	2	೨೧
ಕಿ	-೨	ಇ	೨೦೨	ಗ	೭	3	೩೧
ಕೀ	-೩	ಉ	೨೦೩	ಗ	೮	4	೪೧
ಕು	-೪	ಊ	೨೦೪	ಗ	೯	5	೫೧
ಕು	-೫	ಋ	೨೦೫	ಗ	೧೦	6	೬೧
ಕು	-೬	ೠ	೨೦೬	ಗ	೧೧	7	೭೧
ಕು	-೭	ಎ	೨೦೭	ಗ	೧೨	8	೮೧
ಕು	-೮	ಐ	೨೦೮	ಗ	೧೩	9	೯೧
ಕು	-೯	ಓ	೨೦೯	ಗ	೧೪	10	೧೦೧
ಕಾ	-೧೦	ಔ	೨೧೦				
ಕೀ	-೧೧						
ಕು	-೧೨						
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ಕು	-೯೬						
ಕು	-೯೭						
ಕು	-೯೮						
ಕು	-೯೯						
ಕು	-೧೦೦						

ವಾತು ವೈ ಕುಮಾರಿ ಪತಿಃ = ವಾತು ೧೦೦ ಕುಮಾರಿ ಪತಿಃ

FIGURE 37.

Tulu-Tigalari vowel marks and ligatures. Belongs to the workshop hand-out set seen in the previous page.

SOURCE

The Poornaprajna Samshodhana Mandiram, Bangalore.

VOWEL SIGN U -

Consonant	U	U	U
ku	കു	കു	-
gu	ഗു	ഗു	-
chu	കു	കു	-
ju	കു	കു	-
tu	കു	-	കു
nu	കു	കു	കു
tu	കു	കു	-
nu	കു	-	കു
bhu	കു	കു	-
ru	കു	കു	കു
su	കു	കു	-
hu	കു	കു	-

VOWEL SIGN UU-

Consonant	UU	UU
kū	കു	-
gū	ഗു	-
chū	കു	-
jū	കു	-
tū	കു	കു
nū	കു	കു
bhū	കു	-
rū	കു	കു
sū	കു	-
hū	കു	-

FIGURE 38.

Tulu-Tigalari vowel marks U and UU vary according to the characters they combine with. Also these forms change across manuscripts. This is a tabulated form of these variations put-together by Srinidhi A.

SOURCE

Srinidhi A.

ALPHABET

The letters of the alphabet adopted and the method of their transliteration.

	Kannada	Roman	Nearest English equivalent in pronunciation wherever available
Vowels:	ಉ	u	
	ಊ	uu	
	ಅ	a	u of cut
	ಆ	aa	a of calm
	ಇ	i	i of bit
	ಈ	ii	ee of keep
	ಉ	u	u of put
	ಊ	uu	oo of shoot
	ಋ	r	
	ೠ	rr	
	ಋ	€	a of man
	ೠ	€€	a of mat
	ಏ	e	e of bet
	ಉ	ee	a of mate
	ಓ	o	o of obedience
	ಔ	oo	oa of coat
Diphthongs:	ಐ	ai/ ei	i of like ai of main
	ಏಯ್	ayü/ ay	
	ಏಯಿ	ayi	
	ಏಯಿ	eyi	
	ಔ	au/ ou	ov of love ov of stove
	ಏವ್	avü/ av	
	ಏವು	avu	
	ಏವು	ovu	
Stops unaspirated:	ಕ	ka	k of skin
	ಗ	ga	g of get
	ಚ	ca	ch of church
	ಜ	ja	j of jet
	ಟ	ṭa	t of heat (with the tip of the tongue curled back)
	ಡ	ḍa	d of curd (with the tip of the tongue curled back)

ಪೀಠಕೆ

**Stops
aspirated:**

Alveolar stop:

Nasals :

**Semi-vowels
trills, laterals
and fricatives:**

Also note

Avagraha

ತಾ
ದಾ
ಪಾ
ಬಾಕಾ
ಗಾ
ಚಾ
ಜಾ
ಠಾ
ಢಾ
ಥಾ
ಢಾ
ಫಾ
ಬಾ

ಸತ

ನಾ
ನಾ
ನಾ
ನಾ
ಮಾ
ಮಯಾ
ರಾ
ಲಾ
ವಾ
ಸಾ
ಸಾ
ಹಾ
ಲಾ
ಲಾ
ಹಽ
ಃ
ಃta
da
pa
bakha
gha
cha
jha
ṭha
ḍha
ṭha
ḍha
pha
bha

st

ṇa
na
ṇa
na
ma
mya
ra
la
va
śa
ṣa
sa
ha
ḷa
ḷa
ḥ

stands for ṣ after consonants

stands for ḥ after consonants

stands for deleted vowel in texts

p of copy
b of big

treated as a cluster of
s and ṭ

ṇ of sing
n of bench

n of name
m of man
ṇ before k,kh,g,gh
ṇ before c, ch,j,jh
ṇ before ṭ,ṭh,ḍ,ḍh
n before t,th,d,dh
m before p,ph,b,bh
Also before non-stop
consonants and finally

y of yard
r of tree
l of light
v of very
śh of sheep

s of see
h of head

FIGURE 39.

(Previous page & Above) Tulu Orthography in Kannada Script as listed in the Tulu Lexicon. Tulu has a few additional vowels which are frequently used as discussed earlier: short un-rounded 'u' (A + *Virama*), long un-rounded 'uu' (AA + *Virama*) and short 'e' (E + *Virama*), long 'ee' (EE + *Virama*). These additional phonemes referred to in the above image are already being used in Kannada script for Tulu language.

SOURCE

Tulu Lexicon, Volumes 1-6, Rashtrakavi Govinda Pai Research Centre, M.G.M. College. 1988.

CHAPTER - 1

PHONOLOGY

1.1. INVENTORY

The overall phonemic system of Tulu is as follows:

Vowels :

	Front	Central	Back
High	<i>i ii</i>	<i>ʊ ʊʊ</i>	<i>u uu</i>
Mid	<i>e ee</i>		<i>o oo</i>
Low	<i>ɛ ɛɛ</i>		<i>a aa</i>

Consonants :

Stops and affricates :

voiceless	:	<i>p</i>	<i>t</i>	<i>ʈ</i>	<i>c</i>	<i>k</i>
aspirated	:	<i>ph</i>	<i>th</i>	<i>ʈh</i>	<i>ch</i>	<i>kh</i>
voiced	:	<i>b</i>	<i>d</i>	<i>ɖ</i>	<i>j</i>	<i>g</i>
aspirated	:	<i>bh</i>	<i>dh</i>	<i>ɖh</i>	<i>jh</i>	<i>gh</i>

Sonorants:

nasal	:	<i>m</i>	<i>n</i>	<i>ɳ</i>	<i>ṇ</i>	<i>ṇ̃</i>
oral	:	<i>v</i>	<i>l</i>	<i>ɭ</i>	<i>y</i>	
trill	:		<i>r</i>			
sibilant	:		<i>s</i>	<i>ʃ</i>	<i>ś</i>	
fricative	:					<i>h</i>

The following phonemes have marginal status:

Consonants:

<i>ph</i>	<i>th</i>	<i>ʈh</i>	<i>ch</i>	<i>kh</i>
<i>bh</i>	<i>dh</i>	<i>ɖh</i>	<i>jh</i>	<i>gh</i>
		<i>ʃ</i>	<i>ś</i>	

FIGURE 40.

Tulu language phonetic system. The additional phonetic values are listed here as-well. It is very useful to have these additional characters included in Tulu-Tigalari as-well.

SOURCE

Kekunnaya, Padmanabha. "Chapter 1." A Comparative Study of Tulu Dialects. Udupi, Karnataka: Rashtrakavi Govinda Pai Research Centre, 1994. 21. Print.

Table - 1 (Contd.)

Distribution of Phonemes

<u>Vowels</u>	<u>Initial</u>	<u>Medial</u>	<u>Final</u>
ɪ	+	+	+
ɪɪ	-	+	+
a	+	+	+
aa	+	+	+
u	+	+	+
uu	+	+	+
o	+	+	+
oo	+	+	+

Illustrations :

<u>Vowels</u>	<u>Initial</u>		<u>Medial</u>		<u>Final</u>	
i	irɛ	leaf	kide	cow-pen	aɖi	bottom
ii	iinɛ	You (hon.sg)	niinɛ	water	pui	human excreta
e	edɛ	chest	cembu	copper	aaye	he
ee	eedu	goat	keedu	harm	kaɖec	to grind
ɛ	--	--	--	--	tarɛ	head
ɛɛ	--	--	ɖɛnsɪ	dance	baalɛɛ	O! my dear child
ɪ	ɪnda	Lo! take	naɖɪɪ	to tremble	kaaɖɪ	forest
ɪɪ	--	--	poomɪɪɪde (Nb)	he told: it has gone	tindɪɪɪɪ	it has eaten
a	aŋgi	shirt	karɛ	side	kara	earthen pot
aa	aanɛ	elephant	naalu	four	tinpaa	to cause to eat
u	umi	husk	kuɖu	horsegram	sappu	leaf
uu	uuru	native, village	nuulu	thread	skruu	screw
oo	oŋji	one	koɖɛ	umbrella	tooʃo	garden
oo	ooni	lane	koodi	corner	suupoo (Sb)	to show

FIGURE 41.

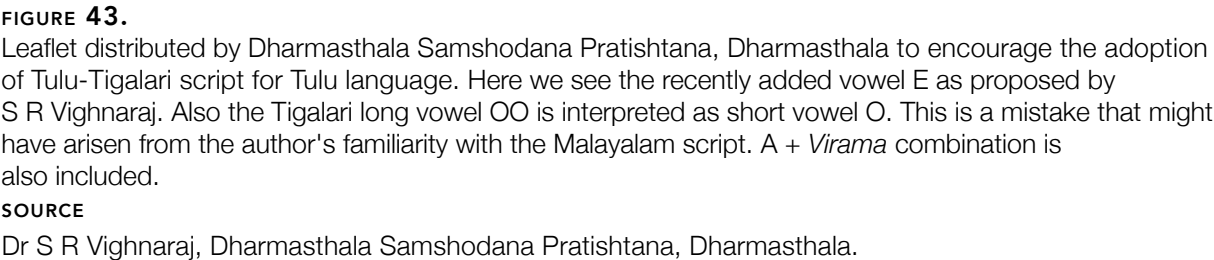
Analysis and examples of Tulu special vowels ɐ, ɐː, ɛ & ɛː in Tulu language.

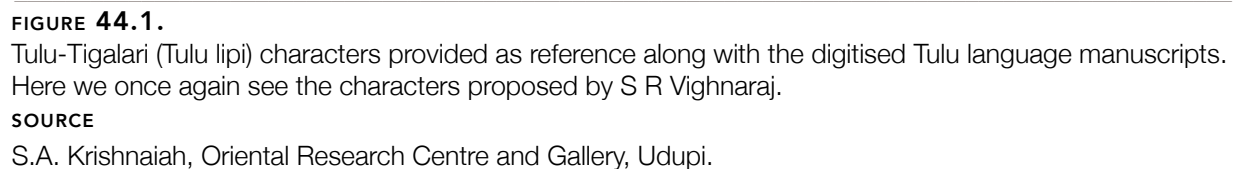
SOURCE

Kekunnaya, Padmanabha. "Chapter 1." A Comparative Study of Tulu Dialects. Udupi, Karnataka: Rashtrakavi Govinda Pai Research Centre, 1994. 22. Print.

ಚಿತ್ರ ಕೃಪೆ : ಡಾ॥ ದೇವರಕೊಂಡಾರೆಡ್ಡಿ

This image credits (source) for this is given to Dr. Devarakonda Reddy below this publication.



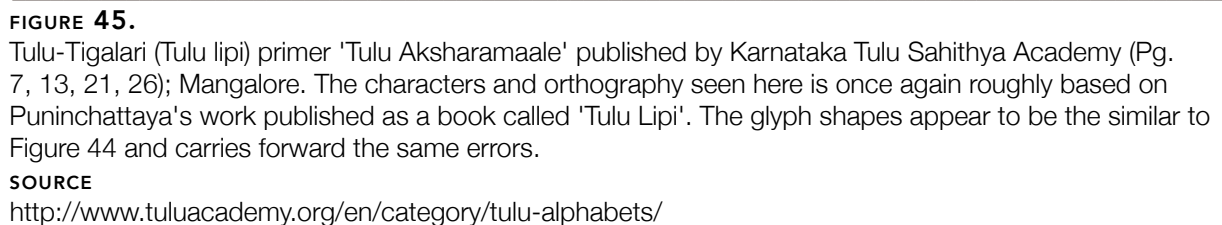


Tulu-Tigalari (Tulu lipi) characters provided as reference along with the digitised Tulu language manuscripts. Here we once again see the characters proposed by S R Vighnaraj.

S.A. Krishnaiah, Oriental Research Centre and Gallery, Udupi.



Puninchathaya, Venkataraja. (Cropped scans from several pages)
Tulu Lipi. Mangalore, Karnataka Tulu Sahitya Academy. Print.



ಪಾಠ ೧

ತುಳು	ಕನ್ನಡ
ಶೋ	ಲ್
ಶೊ	ಲ
ಶೊ	ಲ
ೞ	ಱ
ೞ	ಈ
ೞ	ಲ
಼	ಲ

ತುಳು ರೀತಿ / 7

ಪಾಠ ೨

ತುಳು	ಕನ್ನಡ
ಳ	ಯ
ೞ	ಏ
ೞ	ಐ
ೞ	ಒ
ೞ	ಒ
ೞ೦	ಱ೦
ೞ:	ಱ:

ತುಳು ರೀತಿ / 8

ತುಳು	ಕನ್ನಡ
ದ	ಕ
ೞ	ಖ
ಗ	ಗ
ಱ	ಘ
ಱ	ಒ
ೞ	ಚ
ೞ	ಛ

ತುಳು	ಕನ್ನಡ
ೞ	ಜ
ಱ	ಝ
ಱ	ಞ
ೞ	ಟ
ೞ	ಠ
ೞ	ಡ
ೞ	ಢ

ಪಾಠ ೩

ತುಳು	ಕನ್ನಡ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ

ತುಳು ರೀತಿ / 11

ತುಳು	ಕನ್ನಡ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ

ತುಳು	ಕನ್ನಡ
ೞ	ಯ
ೞ	ರ
ೞ	ಲ
ೞ	ಱ
ೞ	ಱ

ತುಳು	ಕನ್ನಡ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ
ೞ	ಱ

ಪಾಠ ೬

ಒತ್ತಕ್ಕರಗಳು

ತುಳುವಿನಲ್ಲಿ ಒತ್ತಕ್ಕರಗಳನ್ನು ಮೂರು ರೀತಿಯಲ್ಲಿ ಬರೆಯಬಹುದು.

1. ಒಂದು ಮೂಲಾಕ್ಷರದ ಕೆಳಗೆ ಅಥವಾ ಅಕ್ಕಿ ಜೋಡಿಸಿ ಇನ್ನೊಂದು ಮೂಲಾಕ್ಷರವನ್ನೇ ಬರೆಯುವುದು.

ಉದಾ: ಪ್ಲ - ಗ್ಲ ಪ್ಲ - ಗ್ಲ
 ಫ - ಫ ಫ - ಫ
 ಳ - ಳ ಳ - ಳ
 ಕ - ಇಡಾ ಕ - ಇಡಾ

2. ಒಂದು ಮೂಲಾಕ್ಷರಕ್ಕೆ ನಮಗೆ ಬೇಕಾದ ಮೂಲಾಕ್ಷರದ ಸಂಕೇತವನ್ನು ಜೋಡಿಸುವುದು.

ಉದಾ: ಪ್ಲ - ಫಾ ಕ - (ಅ)
 ಫ - ಫ ಪ್ಲ - ಫಾ
 ಪ - ಗ್ಲ ಫ - ತಿ
 ಪ್ಲ - ಇಡಾ ಪ - ಗ
 ಪ್ಲ - ಪ ಪ - ತಿ
 ಪ್ಲ - ಇಡಾ ಪ - ಉ
 ಪ್ಲ - ಗಾ

ತುಳು ರೀತಿ / 24

3. ಒತ್ತಕ್ಕರದ ಮೊದಲ ಅಕ್ಷರವನ್ನು ಆ ಕಾಲಾತ್ಮಕವಾಗಿ ಪರಿವರ್ತಿಸುವುದು.

ಉದಾ: ಪ್ಲ - ಫಾ ಪ್ಲ - ಫಾ

4. ಒತ್ತಕ್ಕರವು ಮಹಾಪ್ರಾಣವಾಗಿದ್ದರೆ ಮೊದಲನೆಯ ಅಕ್ಷರವು ಅಲ್ಪಪ್ರಾಣವಾಗುತ್ತದೆ.

ಉದಾ: ಪ್ಲ - ಪ್ಲಾ ಪ್ಲ - ಪ್ಲಾ

5. ಅನುಪ್ರಾಸಯುಕ್ತವಾದ ಅಕ್ಷರಗಳನ್ನು ಎರಡು ರೀತಿಯಲ್ಲಿ ಬರೆಯಲಾಗುತ್ತದೆ.

ಉದಾ: ಸಂತೆ - ಗುಗುಣ (ಸನ್ನೆ)
 ಗುಗುಣ

ಸಂಠಿ - ಗುಗುಣಿ (ಸನ್ನಿ)
 ಗುಗುಣಿ

ತುಳು ರೀತಿ / 25

3. ತುಳು ವೈಯಕ್ತಿಕ ವಾದಿ

4. ಕೊಡವರು ಬರೆಯುವ ಕೊಡವ ಮಹಾಪ್ರಾಣವನ್ನು ಬರೆಯುವ.

ಈ ಕೆಳಗಿನ ವಾಕ್ಯಗಳನ್ನು ಕನ್ನಡ ರೀತಿಯಲ್ಲಿ ಬರೆಯಿರಿ.

1. 2023 ರಿಂದ ರೀತಿ ರೀತಿ ರೀತಿ
2. 2023 ರಿಂದ ರೀತಿ ರೀತಿ ರೀತಿ
3. 2023 ರಿಂದ ರೀತಿ ರೀತಿ ರೀತಿ
4. 2023 ರಿಂದ ರೀತಿ ರೀತಿ ರೀತಿ

SOURCE
Puninchathaya, Venkataraja. (Cropped scans from several pages) Tulu Lipi. Mangalore, Karnataka Tulu Sahitya Academy. Print.

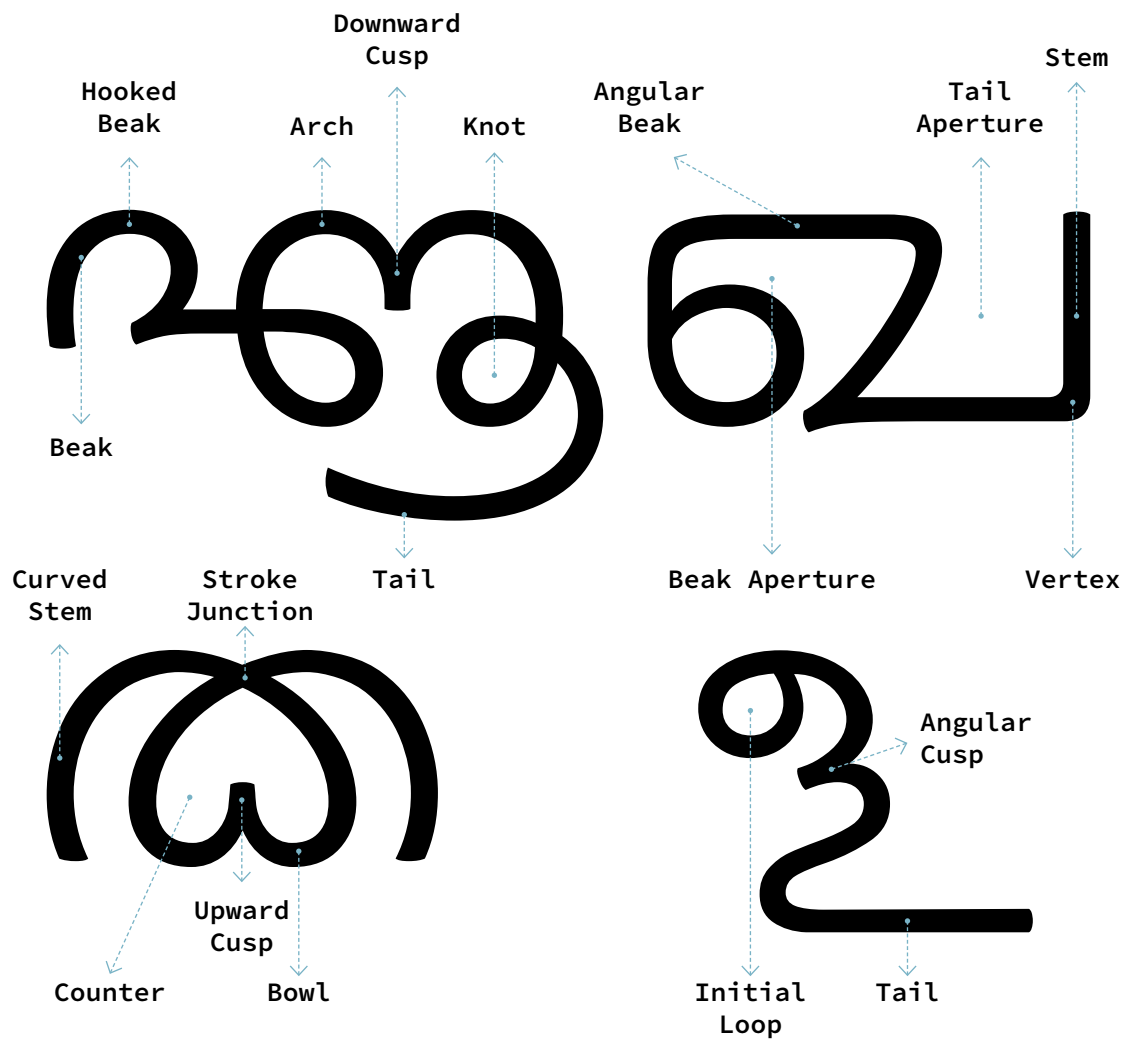


FIGURE 47.
Tulu-Tigalari character anatomy.