Updated proposal to encode the Tulu-Tigalari script in Unicode

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BACKGROUND DOCUMENTS :

This document replaces L2/21-210

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

L2/16-241 (replaces L2/11-120R) 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 & Laurentiu Iancu

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

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

L2/17-378 (replaces L2/16-241) Preliminary proposal to encode Tigalari script
　　　— Vaishnavi Murthy K Y, Vinodh Rajan

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

L2/18-168 Recommendations to UTC #155 April-May 2018 on Script Proposals
　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, Lisa Moore, Liang Hai, Chris Chapman,
　　　　and Richard Cook

L2/18-241 Recommendations to UTC #156 January 2018 on Script Proposals
　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, Lisa Moore, Liang Hai, Chris Chapman, Richard Cook,
　　　　Norbert Lindenberg, and Ben Yang

L2/18-232 Feedback on *pushpika*
　　　— Deborah Anderson

L2/20-279 Comments on differences between Tulu and Tigalari proposals
　　　　— Jan Kučera

L2/21-016 Recommendations to UTC #166 January 2021 on Script Proposals
　　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, Lisa Moore, and Liang Hai

L2/21-086 (replaces L2/17-378) Updated proposal to encode Tulu-Tigalari script in Unicode
　　　　— Vaishnavi Murthy Kodipady Yerkadithaya, Vinodh Rajan

L2/21-174 Recommendations to UTC #169 October 2021 on Script Proposals
　　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, and Liang Hai

L2/21-073 Recommendations to UTC #167 April 2021 on Script Proposals
　　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, Lisa Moore, and Liang Hai

L2/21-092 Proposal to postpone encoding of the new Tulu script from the Karnataka Tulu Sahitya Academy
　　　　— Vinodh Rajan, Liang Hai, Srinidhi A, Sridatta A, Vaishnavi Murthy Yerkadithaya

L2/21-130 Recommendations to UTC #168 July 2021 on Script Proposals
　　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, and Liang Hai

L2/21-147 Replies to Recommendations to UTC #167 April 2021 on Script Proposals
　　　　Norbert Lindenberg's email with comments 10 April 2021
　　　　— Vaishnavi Murthy Kodipady Yerkadithaya, Vinodh Rajan

L2/21-146 (replaces L2/21-086) Updated proposal to encode Tulu-Tigalari script in Unicode
　　　　— Vaishnavi Murthy Kodipady Yerkadithaya, Vinodh Rajan

L2/21-174 Recommendations to UTC #169 October 2021 on Script Proposals
　　　　— Deborah Anderson, Ken Whistler, Roozbeh Pournader, and Liang Hai

L2/21-210 (replaces L2/21-146) Updated proposal to encode Tulu-Tigalari script in Unicode
　　　　— Vaishnavi Murthy Kodipady Yerkadithaya, Vinodh Rajan

L2/21-211 A list of common Tulu-Tigalari conjuncts
　　　　— Vaishnavi Murthy, Vinodh Rajan

LETTERS OF SUPPORT :

L2/17-422 Letter to Vaishnavi Murthy in support of Tigalari encoding proposal
　　　　— A. V. Nagasampige, Poornaprajna Samshodhana Mandiram

L2/21-212 Two letters of support for the Tulu-Tigalari proposal by Vaishnavi Murthy and Vinodh Rajan
　　　　— P. Jha, National Manuscript Mission, IGNCA; Sri. B. Gopalacharya, Sri Vadiraja Research Foundation

Contents :

KEY :   **V.S.**   Vowel Sign

V / V.S. Vowel / Vowel Sign

L.Vir   Looped 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. All the recommendations made in this proposal are the authors' view alone. Srinidhi A and Sridatta A have generously shared their original research into the Tulu-Tigalari script orthography with the authors. Their work and feedback is integrated into this paper.

The Tulu-Tigalari[1] 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.

Tulu-Tigalari was not 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 is 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.

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1   Tuḷu-Tigaḷāri

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 complied 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 : https://www.ifpindia.org/resources/manuscripts/

1.1   Script Name

The script being proposed here was referred to by several names. The four commonly used ones are listed below (Refer to the supplementary paper 'Naming the 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	19th Century Western scholars.
Tulu Lipi / Taulava Lipi	Coastal Karnataka	Tulu speakers, Tulu Sahitya Academy Used by scholars like : Dr. P Venkataraj Punichittaya & A C Burnell.
Tigalari / Tigalarya	Tulunadu, *Malenadu*[5] (hilly regions of Karnataka), Uttara Kannada	Kannada speakers. Havyaka Community of both *Tulunadu* and *Malenadu*, National Manuscript Mission Catalogues : popularised by Keladi Gunda Jois. Recoded by Dr P Venkataraj Punichittaya as an alias in his books.
Grantha Lipi / Tulu 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 examined 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

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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

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'.

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.

In a very general sense, Tigalari can be used to refer to all Grantha based scripts in Karnataka. Thus, the specific term 'Tulu-Tigalari' also serves to distinguish this particular style of the Tigalari script used in the western regions of Karnataka from c. 11th Century onwards.

The Tulu-Tigalari script proposal will cover only the traditional script's orthography. This includes the stone inscriptions as well as the manuscript forms. There have been some attempts to reform the script by adding characters and simplifying the script in order to imitate the behaviour of the Kannada/Malayalam scripts. We are of the opinion that the reformed script should be dealt separately when it matures and is widely adopted. (Refer L2/21-092)

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). 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.

2   History of Tulu-Tigalari Script

There is a lack of material/research available for accurately dating the arrival of this script in 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 Hindu *guru* Madhwacharya's student Hrishikesha Teertha recording Madhwa's teachings using this script. These manuscripts are called *Sarvamoola Grantha* or the root books.[6] From this, based on the time-period that Madhwacharya might have been alive, we can comfortably come to the conclusion that Tuḷu 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.[7] 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.[8]

The regions where Tulu-Tigalari was used have been centres of learning for centuries and still continue 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.

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6   http://www.sciencedaily.com/releases/2006/09/060919102046.htm

7   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.

8   Several stone inscriptions found in Udupi Taluk and Kasargod are currently being examined and are tentatively dated from to mid 12th century onwards, based on the name references.

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.

3 Current Situation

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

Page 1 of this document lists several proposals and documents that have been submitted to encode the Tulu-Tigalari script into Unicode. Over the years, the proposals have been refined to identify the orthography and behaviour of this script which allows for closely representing the Tulu-Tigalari script as found in the manuscripts and stone inscriptions.

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 Grantha[9] and Malayalam scripts** (Refer Figure 6)[10].

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

10   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.

5.1 Independent Vowels (*Swarakshara*)

Tulu-Tigalari has 14 independent vowels or *Swarakshara* which includes 2 diphthongs (TULU-TIGALARI LETTER AI & TULU-TIGALARI LETTER AU) along with *Anusvara* and *Visarga*. *Anusvara* and *Visarga* are discussed under Section 5.7.

Following the precedence of previously encoded Indic scripts, the 14 vowels are proposed to be encoded atomically, as shown below. TULU-TIGALARI LETTER VOCALIC RR (ೞ), TULU-TIGALARI LETTER VOCALIC L (ೞ) and TULU-TIGALARI LETTER VOCALIC LL (ೞ) are rare. They appear in manuscripts that list the alphabet and in Mandalas as *beejaksharas*.

TULU-TIGALARI LETTER A (a)	ೞ
TULU-TIGALARI LETTER AA (ā)	ೞ
TULU-TIGALARI LETTER I (i)	ೞ
TULU-TIGALARI LETTER II (ī)	ೞ ≡ ೞ + ◌ೞ
TULU-TIGALARI LETTER U (u)	ೞ
TULU-TIGALARI LETTER UU (ū)	ೞ ≡ ೞ + ◌
TULU-TIGALARI LETTER VOCALIC R (r̥)	ೞ
TULU-TIGALARI LETTER VOCALIC RR (r̥̄)	ೞ
TULU-TIGALARI LETTER VOCALIC L (l̥)	ೞ
TULU-TIGALARI LETTER VOCALIC LL (l̥̄)	ೞ
TULU-TIGALARI LETTER EE (ē)	ೞ
TULU-TIGALARI LETTER AI (ai)	ೞ ≡ ೞ + ೞ◌
TULU-TIGALARI LETTER OO (ō)	ೞ
TULU-TIGALARI LETTER AU (au)	ೞ ≡ ೞ + ◌ೞ

However, canonical decompositions have been provided for those vowels (Refer Section 5.2.1) that can be analysed as being composed of multiple glyphic structures as indicated above in grey. While many of the legacy Indic scripts, resort to the use of "*do not use*" tables, its been observed that some users inadvertently try to form such vowels using composite sequences (e.g. DEVANAGARI INDEPENDENT VOWEL AA as U+0905 DEVANAGARI LETTER A [अ] & U+093E DEVANAGARI VOWEL SIGN AA [◌ा] instead of U+0906 DEVANAGARI LETTER AA [आ]). This frequently results in the generation of malformed text[11]. Providing canonical decompositions ensure that such composite sequences are equivalent to the atomic forms, ensuring clean data in the future.

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 here.

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11   Libraries such as *Nisaba* (https://github.com/google-research/nisaba) provide tools to clean such malformed text.

5.2   Dependent Vowel Signs

All independent *Swarakshara* have their corresponding dependent vowel signs except for TULU-
TIGALARI LETTER A (inherent). These signs are positioned to the left, right, above or below
consonants/conjuncts, replacing the final inherent vowel 'A'. Dependent vowel signs in Tulu-
Tigalari can be categorised as :

(a.) Right Spacing Vowel Signs

(b.) Vowel Signs Re-Ordered to the Left of the Base Character

(c.) Two Part Vowel Signs

(d.) Vowel Signs Placed Below & Ligating to the Right

(e.) Placed Below [or] Placed Below & Ligating to the Right

(a.)   Right Spacing Vowel Signs

TULU-TIGALARI VOWEL SIGNS AA, I & II are placed to the right of a character/conjunct.

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TULU-TIGALARI VOWEL SIGN AA (ā)  ◌ꠋ
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 കാ   =   ക   +   ◌ാ
KA.A   KA   A-v.s.

Behavior ക – �വ :

ത്ാ ഭ്ാ ഗ്ാ ഘ്ാ ങ്ാ ച്ാ ഛ്ാ ജ്ാ ഝ്ാ ഞ്ാ ട്ാ ഠ്ാ ഡ്ാ
ഢ്ാ ണ്ാ ത്ാ ഥ്ാ ദ്ാ ധ്ാ ന്ാ പ്ാ ഫ്ാ ബ്ാ ഭ്ാ മ്ാ യ്ാ
ര്ാ റ്ാ ല്ാ ള്ാ ഴ്ാ വ്ാ ശ്ാ ഷ്ാ സ്ാ ഹ്ാ

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TULU-TIGALARI VOWEL SIGN I  (i) ◌ꠛ
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കി   =   ക   +   ◌ി
KI   KA   I-v.s.

Behavior ക – �വ :

കി ഭി ഗി ഘി ങി ചി ഛി ജി ഝി ഞി ടി ഠി ഡി
ഢി ണി തി ഥി ദി ധി നി പി ഫി ബി ഭി മി യി
രി റി ലി ളി ഴി വി ശി ഷി സി ഹി

TULU-TIGALARI VOWEL SIGN II (ī) ◌ী

ത্রী   =   ത   +   ী
KII   KA   II-v.s.

Behavior ത – ന :

ক্রী ফ্রী গ্রী ঞ্রী ণ্রী চ্রী ক্ষ্রী ম্রী ঝ্রী ঞ্রী ড্রী ঢ্রী ঢ্রী
ষ্রী ণ্রী ত্রী থ্রী দ্রী ধ্রী ন্রী প্রী ফ্রী ব্রী হ্রী ম্রী ঝ্রী
ব্রী ভ্রী ল্রী ট্রী ঠ্রী ড্রী শ্রী ষ্রী স্রী হ্রী

(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) ৭◌

৭ত   =   ত   +   ৭◌
KEE   KA   EE-v.s.

Behavior ത – ന :

৭ত্র ৭ছে ৭গ ৭য ৭ণ্ ৭চ ৭ম ৭ঝ ৭ঝ ৭ঞ ৭দ্
৭ঙ ৭ড ৭ঢ ৭ণ ৭ত ৭থ ৭দ্ ৭ধ ৭ন ৭প ৭ফ ৭ব
৭ধ ৭ম ৭ঝ ৭র ৭ল্ল ৭ল ৭ল্ ৭ল্ল ৭স ৭শ ৭ষ ৭স ৭হ

TULU-TIGALARI VOWEL SIGN AI (ai) ৭৭◌

৭৭◌   ≡   ৭◌   +   ৭◌
AI-v.s.   EE-v.s.   EE-v.s

৭৭ত   =   ত   +   ৭৭◌
KAI   KA   AI-v.s.

       ≡   ത   +   ৭◌   +   ৭◌
            KA   EE-v.s.   EE-v.s.

While the analogous characters in Grantha, Malayalam and Sinhala do not have decompositions, we have provided decompositions for this vowel Sign in-order to completely avoid the '*do not use*' tables and to keep the encoding model consistent with other characters that merit decomposition within this proposal.

Behavior ഝ – ഡ :

ൈത ൈഛ ൈഗ ൈഝ ൈങ ൈച ൈഖ ൈശ ൈഎ

ൈഞ ൈട ൈഠ ൈഡ ൈഢ ൈണ ൈത ൈഥ ൈദ ൈധ

ൈന ൈപ ൈഫ ൈബ ൈഭ ൈമ ൈയ ൈര ൈഌ

ൈല ൈൗ ൈഐ ൈവ ൈശ ൈഷ ൈസ ൈഡ

(c.)   Two Part Vowel Signs

TULU-TIGALARI 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 .

A two-part vowel can be represented by a single code point, mapped to a glyph representing the composite, and then split into its components at the glyph level to implement the reordering. The equivalence decomposition information for the rendering engines is as follows :

TULU-TIGALARI VOWEL SIGN OO (ō)   െ◌ാ

െ◌ാ   ≡   െ◌   +   ◌ാ

|OO-v.s. |EE-v.s. |A-v.s.

െത്താ   =   ഝ   +   െ◌ാ
|KOO |KA |OO-v.s.

         ≡   ഝ   +   െ◌   +   ◌ാ
               |KA |EE-v.s. |A-v.s.

Behavior ഝ – ഡ :

െത്താ െഛ്ബാ െഗാ െഝ്യാ െങ്ങാ െചാ െശാ െശാ െഎാ

െഞ്ചാ െട്ടാ െഠാ െഡ്ധാ െഢ്ഢാ െണ്ണാ െതാ െഥ്ഥാ െ്ദാ െധാ

െനാ െപ്പാ െഫ്ഫാ െബ്ബാ െഭ്ധാ െമാ െഎാ െരാ െഌ്ഴാ െലാ

ൌ്ളാ െഐാ െവാ െശ്ശാ െഷ്ഷാ െസ്സാ െഡാ

TULU-TIGALARI VOWEL SIGN AU (au)

AU-v.s.	≡	EE-v.s.	+	AU-length mark

KAU	=	KA	+	AU-v.s.

	≡	KA	+	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'.)[12].

TULU-TIGALARI VOWEL SIGN U (u)

(Default representation form :)

PU	=	PA	+	U-v.s.

CHU	=	CHA	+	U-v.s.

---

12   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)

ಞ = ಞ + ಿ
KU   KA   U-v.s.

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

Behavior ಞ – ಞ (Common forms in GREEN + Alternate forms) :

[Tulu-Tigalari script examples]

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

ಞ = ಞ + ಿ
CHUU   CHA   UU-v.s.

ಞ = ಞ + ಿ
KHUU   KHA   UU-vs

Behavior ಞ – ಞ (Common forms in GREEN + Alternate forms) :

[Tulu-Tigalari script examples]

TULU-TIGALARI VOWEL SIGN VOCALIC R (ṛ)

ಞ = ಞ + ಿ
KRU   KA   Vocalic RR-v.s.

Behavior ಕ – ಞ :

ಕೄ ಖೄ ಗೄ ಘೄ ಙೄ ಚೄ ಛೄ ಜೄ ಝೄ ಞೄ ನ ಣ ಡೄ ಢೄ ಣೄ

ತೄ ಥೄ ದೄ ಧೄ ನೄ ಪೄ ಫೄ ಬೄ ಮೄ ಯ ರ ಱ ಲೄ ವೄ ಶೄ ಷೄ

ಸೄ ಹೄ ಳೄ ೞೄ ಕ್ಷೄ

TULU-TIGALARI VOWEL SIGN VOCALIC RR (r̄) ೄ

ಕೄ   =   ಕ   +   ◌ೄ

KRUU   KA   Vocalic RR-v.s.

Behavior ಕ – ಞ :

ಕೄ ಖೄ ಗೄ ಘೄ ಙೄ ಚೄ ಛೄ ಜೄ ಝೄ ಞೄ ನ ಣ ಡೄ ಢೄ ಣೄ

ತೄ ಥೄ ದೄ ಧೄ ನೄ ಪೄ ಫೄ ಬೄ ಮೄ ಯ ರ ಱ ಲೄ ವೄ ಶೄ ಷೄ

ಸೄ ಹೄ ಳೄ ೞೄ ಕ್ಷೄ

(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 rate to come-by in manuscripts.

The Vowel sign for Vocalic L has two varying forms[13]. 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 (◌) (*This is the most commonly used form of Tulu-Tigalari manuscripts*)

2.) Below + right ligating (◌)[14]

Further illustrating their behaviour :

TULU-TIGALARI VOWEL SIGN VOCALIC L (ḷ) ◌

---

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

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

ಕ್ಲು   =   ಕ   +   ◌ಳು
KLU   KA   Vocalic L-v.s.

Behavior ಕ – ಹ :

(Tulu-Tigalari script combining forms grid — vocalic L vowel sign applied to consonants ಕ through ಹ)

TULU-TIGALARI VOWEL SIGN VOCALIC L (ḷ) ◌ಳು

ಕ್ಲು   =   ಕ   +   ◌ಳು
KLU   KA   Vocalic L-v.s. (alternate form)

Behavior ಕ – ಹ :

(Tulu-Tigalari script combining forms grid — vocalic L vowel sign alternate form applied to consonants ಕ through ಹ)

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

TULU-TIGALARI VOWEL SIGN VOCALIC LL (ḹ)   ◌ಳಿ

ಕ್ಲೂ   =   ಕ   +   ◌ಳಿ
KLUU   KA   Vocalic LL-v.s.

Behavior ಕ – ಹ :

(Tulu-Tigalari script combining forms grid — vocalic LL vowel sign applied to consonants ಕ through ಹ)

5.2.1 Dependent Vowel Signs used for Independent Vowels (Decompositions)

The VOWEL SIGNS U, EE & AU LENGTH MARK are also used in the canonical decompositions of the independent TULU-TIGALARI VOWELS II, UU, AI & AU (Refer Section 5.1) :

ೞ   ≡   ೞ +   ೞ
II   I   AU-v.s.

ೞ   ≡   ೞ +   ೞ
UU   U   UU-v.s.

ೞ   ≡   ೞ +   ೞ
AI   EE   EE-v.s.

ೞ   ≡   ೞ +   ೞ
AU   OO   AU-v.s.

We recommend handing the alternate/rare forms of vowels letters II (ೞ , ೞ) and UU (ೞ , ೞ) as sequences shown below :

ೞ   =   ೞ +   ೞ
II(RARE.1)   I   AA-v.s.

ೞ   =   ೞ +   ೞ
II(RARE.2)   I   UU-v.s.

ೞ   =   ೞ +   ೞ
UU(RARE.1)   U   UU-v.s.

ೞ   =   ೞ +   ೞ
UU(RARE.2)   U   AU-length mark

5.3   Consonants & Semi-vowels (*Vyanjanakshara*)

Consonants and semi-vowels 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
Gutteral	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 below-base/post-base form called *Adi vottu*[15]. The behaviour of
Adi vottu is further discussed under Section 5.6. *(Alternate Glyph Shapes are under section 6.1)*

	CONSONANTS	POST—BASE / BELOW—BASE FORMS
TULU-TIGALARI LETTER KA (ka)	ಕ	◌
TULU-TIGALARI LETTER KHA (kha)	ಖ	◌
TULU-TIGALARI LETTER GA (ga)	ಗ	◌
TULU-TIGALARI LETTER GHA (gha)	ಘ	◌
TULU-TIGALARI LETTER NGA (ṅa)	ಙ	◌
TULU-TIGALARI LETTER CA (ca)	ಚ	◌
TULU-TIGALARI LETTER CHA (cha)	ಛ	◌
TULU-TIGALARI LETTER JA (ja)	ಜ	◌
TULU-TIGALARI LETTER JHA (jha)	ಝ	◌
TULU-TIGALARI LETTER NYA (ña)	ಞ	◌
TULU-TIGALARI LETTER TTA (ṭa)	ಟ	◌
TULU-TIGALARI LETTER TTHA (ṭha)	ಠ	◌
TULU-TIGALARI LETTER DDA (ḍa)	ಡ	◌
TULU-TIGALARI LETTER DDHA (ḍha)	ಢ	◌
TULU-TIGALARI LETTER NNA (ṇa)	ಣ	◌
TULU-TIGALARI LETTER TA (ta)	ತ	◌
TULU-TIGALARI LETTER THA (tha)	ಥ	◌
TULU-TIGALARI LETTER DA (da)	ದ	◌
TULU-TIGALARI LETTER DHA (dha)	ಧ	◌
TULU-TIGALARI LETTER NA (na)	ನ	◌
TULU-TIGALARI LETTER PA (pa)	ಪ	◌
TULU-TIGALARI LETTER PHA (pha)	ಫ	◌
TULU-TIGALARI LETTER BA (ba)	ಬ	◌
TULU-TIGALARI LETTER BHA (bha)	ಭ	◌

---

15   The term '*adi vottu*' is borrowed from Kannada.

TULU-TIGALARI LETTER MA (ma)	౨	◌౨
TULU-TIGALARI LETTER YA (ya)	ఇ	◌ఇ
TULU-TIGALARI LETTER RA (ra)	ಱ	◌
TULU-TIGALARI LETTER LA (la)	ల	◌
TULU-TIGALARI LETTER VA (va)	೧	◌
TULU-TIGALARI LETTER SSA (śa)	ೕ	◌ೕ
TULU-TIGALARI LETTER SHA (ṣa)	ೕ	◌ೕ
TULU-TIGALARI LETTER SA (sa)	౫	◌౫
TULU-TIGALARI LETTER HA (ha)	౧	◌౧
TULU-TIGALARI LETTER LA (ḷa)	౩	◌౩

Tulu-Tigalari has two characters that represent the Dravidian sounds : LLLA (ḻa)) and RRA (ṟa, 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 Dravidian phonemes in Tulu-Tigalari manuscripts studied so far that a space for the TULU-TIGALARI LETTER NNNA is reserved.

TULU-TIGALARI LETTER LLLA (ḻa)	ఴ	◌ఴ
TULU-TIGALARI LETTER RRA (ṟa)	ఴ	◌ఴ

5.4 Virama

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.
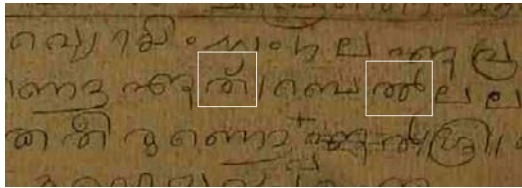
The special vowels ꙙ & ꙙ: appear frequently in the Tulu language, Tulu-Tigalari script manuscripts. We see the use of the Virama character combined with the base V./V.S. A, AA & EE to represent these additional vowels. The Tulu language, Tulu-Tigalari script manuscripts often contain several successive characters with the Virama sign employed to represent these sounds. For example:

EXAMPLE 1 : (*LEFT*) *N* ಗ, *K* ದರ, *Tulu Word : INKꞋ* , ಇನ್ಕ್
(*CENTRE*) *LL* ,̤ *TT* ತು , *Tulu Word : KOLLꞋTTꞋ* , ಕೊಳ್ತ್ತ್
(*RIGHT*) *TT* ತು , *TT* ತು , *Tulu Word : ITTꞋTTꞋ* , ಇತ್ತ್ತ್
(*SOURCE*) *Tulu Ananta Vruta Kathe, Govinda Pai Research Centre, Udupi*

A Virama that also functions 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 separate Conjoiner to create ligatures.

As seen in the Example 1 above, apart from the disjunct form of the Virama (centre, right), a distinct looped-form of the Virama (left) forms ligatures with certain consonants/conjuncts. It is to be noted here that there is no particular rule found for the disjunct and conjunct Virama forms. Both the Virama forms sometimes appear with the same base consonant within a manuscript leaf as illustrated in Example 2 below. This behaviour is therefore not entirely 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 strong preference for the Looped Virama to form ligatures with the characters listed below :

Consonants :

K ದರ	G ಖರ	TT ৳/ ৳	T ತರ	N ಗ

Conjunct sequences :

K.K ದದರ	K.N ದಗ	K.T ದತರ	K.TT ದ৳

TT.TT ৳

T.T ತತರ	T.K ತದರ	T.N ತಗ

N.N ಗಗ	N.T ಗತರ	N.TT ಗ৳

The proposed solution to simplify the explicit display of the Viramas and forming conjuncts would involve supporting the characters listed below :

(a.) Virama - ◌̆

The Virama character will be independently encoded. It will used to represent the Vowel suppressant and the Tulu vowels ꣡ & ꣡:.

(b.) Conjoiner - ⊡

A Conjoiner 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** (◌̆)

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

ಹ಼ಹ   =   ಹ   +   ◌̆   +   ಹ
K(ə).KA   KA   Virama   KA

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

ಹ಼ಲ಼   =   ಹ   +   ◌̆   +   ಲ   +   ◌̆
K(ə).L(ə)   KA   Virama   LA   Virama

The Virama combinations with V./V.S. A, AA, I, II, U, UU, EE and OO [16] 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. The common combinations are marked in Green :

ಞಕ಼ ಞಕ಼ ೧಼ ೧಼ ಲ಼ ಲ಼ ೮಼ ಞ಼
◌̆ ◌ಌ಼ ಬ಼ ಬ಼ ೧಼ ೧಼ ೨◌̆ ೨◌಼
A+Vir. AA+Vir. I+Vir. II+Vir. U+Vir. UU+Vir. EE+Vir. OO+Vir

---

16   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 (ⱳ) → Vowel Sign (◌ꞑ) → Virama (◌̆)     =    ⱳꞑ̆
```

The above sequence would not render properly in the Universal Shaping Engine (USE) as it expects the Above-Base vowel signs to precede the Post-Base vowel signs. Here, Virama effectively acts a diacritic mark that modifies the preceding vowel sign. It is probably counter-intuitive therefore to expect users to input Virama before the vowel sign. **We suggest a USE override for Tulu Virama by assigning it the value of 'Bindu'.** This will allow it to appear at cluster-final positions as illustrated above.

(b.)   Conjoiner (⊕ **)**

(*The '+' placed below a dotted circle [◌̟] representation for a Conjoiner glyph as seen in other scripts will be used instead for the correction sign [Tiddu] in manuscripts across various scripts including Tulu-Tigalari. Therefore, the Glyph :* ⊕ *is used here for the Conjoiner.*)

The Conjoiner character is used to call ligature forms.

⓪	=	⓪	+	⊕	+	⓪
K.KA		KA		Conjoiner		KA

⓪	=	⓪	+	⊕	+	ⱳ
K.DA		KA		Conjoiner		DHA

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

⓪̆ =	⓪	+	⊕	+	ℓ	+	◌̆
K.L(ə)	KA		Conjoiner		LA		Virama

When there are multiple ways to represent a particular sequence of ligating characters[17], it is recommended to handle this at the font level. If, at a later date, a need arises wherein the users choose to have greater control over this representation, this basic behaviour can be easily modified as per their requirements. However, in general Tulu-Tigalari prefers horizontal ligatures (if attested) over stacked vertical conjuncts.

⓪/⓪	=	⓪	+	⊕	+	⓪
K.KA		KA		Conjoiner		KA

Broken/Incorrect Rendering :

| ⓪ ⊕ ⓪	=	⓪	+	⊕	+	⓪
K.K		KA		Conjoiner		KA

---

17   The commonly found ligatures in Tulu-Tigalari manuscripts are listed in the supplementary paper titled, 'A list of common Tulu-Tigalari Conjuncts'.

(c.)   Looped Virama (⟲6)

The Looped Virama is used to call the Virama ligatures that form with the following consonants : KA (ಹ6), GA (ಟ6), TTA (ゲ/ᕍ), TA (ಹ6) & NA (ಗ6). The Looped Virama is tightly bound to the preceding character and does not apply at a syllable level.

ಹ6   =   ಹ   +   ⟲6
K   KA   L.Vir

Conjunct sequences that end with a Looped Virama are rare. Some ligatures that combine with a Looped Virama are : K.K ಹಹ6, K.N ಹಗ6, K.T ಹಹ6, K.TT ಹゲ, TT.TT ゲ, T.T ಹಹ6 , T.K ಹಹ6, T.N ಹಗ6, N.N ಗ6, N.T ಗ6 & N.TT ಗゲ. As this is not a predictable sequence at this stage of the encoding, there is no need to restrict the behaviour of Looped Virama.
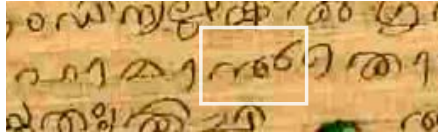
EXAMPLE 3 : *NT* ಗ6
(*SOURCE*) *Tulu Ananta Vruta Kathe, Govinda Pai Research Centre, Udupi*

ಹಹ6   =   ಹ   +   ⊙   +   ಹ   +   ⟲6
K.K   KA   Conjoiner   KA   L.Vir

It is rare to find clusters where characters with Looped Virama act as a base for conjuncts as seen below in Example 4.

EXAMPLE 4 : *Examples of Looped Virama Conjuncts*
            (*TOP LEFT*)   **T.PAA :** *T* ಹ6, *P* ಲ, *Vowel Sign AA* ◌ಾ
            (*TOP RIGHT*) **T.P.RA :** *T* ಹ6, *P* ಲ, *RA* ◌
            (*BOTTOM*) **T.P.ROO :** *T* ಹ6, *P* ಲ, *RA* ◌, *Vowel Sign OO* ಾ◌ಾ
(*SOURCE*) *Taraprakashana, Bangalore*

For the above sequences to be rendered without any issues. We suggest a USE override for the Looped Virama by assigning it the value of 'Consonant Modifier'.

ಹ6
ಹ   =   ಹ   +   ⟲6   +   ⊙   +   ಹ
K.KA   KA   L.Vir   Conjoiner   KA

As seen illustrated in the above two examples, the Looped Virama is indeed bound to the preceding consonant.

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

ಞಲಞ̆ = ಞ + ಿ6 + ಞ + ೦̆

K.K(ə)   KA   L.Vir   KA   Virama

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 :

ಞಞ6 = ಞ + ⊡ + ಞ + 6

K.K   KA   Conjoiner KA   L.Vir

ಞ6 ⊡ ಞ = ಞ + 6 + ⊡ +   ಞ

K.KA   KA   L.Vir   Conjoiner   KA

ಐ6 = ಐ + 6

TH   THA   L.Vir

5.5   Repha

In connection to Tulu-Tigalari, the term *Repha* instead of *Reph* is recommended as it is closer to the term used to describe this character.

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 (◌̈) 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

(c.) As a special conjunct

(a.)   **Explicit Initial RA in a Cluster**

The initial RA+Virama in a conjunct sequence is used independently as seen in several manuscripts. This sequence is commonly used to represent the phonetic syllable 'rə' :

ඊ	=	ⱺ	+	◌̆	+	ⱺ
R.YA		RA		Virama		YA

EXAMPLE 5 : *PuDAR̩TTAaVA. Tulu language manuscript.*
(*SOURCE*) *Anantavruta Kathe, Govinda Pai Research Centre, Udupi*

The initial RA is also retained as a base glyph in rare cases, when the succeeding consonant displays conjoining behaviour. As expected, we use the conjoiner in such cases.

ⱺ	=	ⱺ	+	⊡	+	ⱺ
R.YA		RA		Conjoiner		YA
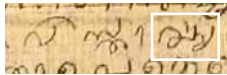
EXAMPLE 6 : *KAaRYoKAaRANNAm. Tulu language manuscript.*
(*SOURCE*) *Anantavruta Kathe, Govinda Pai Research Centre, Udupi*

(b.)   **As a Combining Mark :** Repha – ◌̇

Tulu-Tigalari most commonly uses a Repha form that is placed above the base consonant/conjunct to represent R-initial conjuncts: (◌̇). Encoding the Repha as a separate character avoids the use of ZWJ as seen in scripts like Telugu and greatly simplifies the encoding model. The conventional Repha form appears as illustrated below. The Repha, a short vertical line, is placed above the base glyph :

ⱺ̇	=	◌̇	+	ⱺ
R.YA		Repha		YA

EXAMPLE 7 : *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 the font level. The input sequence is as follows :

ಕ್ಕಾ   =   ◌   +   ക   +   ◌ി   +   ◌̆
R.K(ə:)   Repha   KA   AA-v.s.   Virama
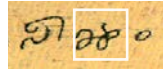
(c.)   As a Special Conjunct

Repha produces conjuncts with the following three consonants :

R.MA - ಕ್ / ಕ್
R.YA - ಕ್
R.VA - ಕ್/ಕ್

EXAMPLE 8 : Vii<u>RYA</u>m. Sanskrit language manuscript.
(*SOURCE*) *Ramayana, Dodmane, Uduipi.*

These are to be considered equivalent glyph variants and handled at the font-level. That is, the font chooses the appropriate form of the Repha to be produced. The conjunct form of Repha for the above three base consonants : MA, YA & VA is recommended as a default for all Tulu-Tigalari fonts. We recommend using font level features to access the alternate forms of the Repha.

ಕ್ / ಕ್ =   ◌   +   ಕ
R.YA   Repha   YA

The Repha ligature can also combine with other conjoining forms :

ಕ್   =   ◌   +   ಕ   +   ◌   +   ಕ
R.Y.YA   Repha   YA   Conjoiner   YA
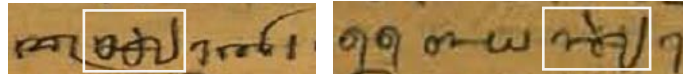
EXAMPLE 9 : *We find the Repha ligature combining with other conjoining forms here in a Sanskrit language manuscript.*
          (*LEFT*) *RYYAa.*
          (*RIGHT*) *RVYAaa.*
(*SOURCE*) *Srinidhi A*

Notes on Repha Combining with Vowels :

In several Tulu-Tigalari manuscripts we find the Repha combining with the Vowels Vocalic R, Vocalic RR & Vocalic L. Repha + Voc. R occurs in Sanskrit in words such as nirRti. This sequence needs to be supported in Tulu-Tigalari.

EXAMPLE 10 : *NaiRRtyaam. Sanskrit language manuscript.*
(*SOURCE*) *Personal Collection*

Vocalic RR	=	Repha	+	Vocalic R	
Vocalic RR	=	Repha	+	Vocalic RR	
Vocalic LL	=	Repha	+	Vocalic L	

Visual Placement of Repha :

The Repha is placed directly above a character/conjunct (centred). This placement is most commonly seen used in manuscripts and is the recommended form with all characters.

5.6   Ligature Formation

A maximum of four consonant/semi-vowel characters can be found in Tulu-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 (Refer paper : L2/21-211, A list of common Tulu-Tigalari conjuncts). 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 below. It is hard to come to a consensus and identify a definitive conjunct/ligature set or shape for this script as of now. As discussed in Section 5.4, we strongly recommend that the alternate forms of ligatures (stacked vs horizontal) be handled at the font level :

ᴍᴍᴍ = ᴍᴍ + ⊙ + ᴍᴍ (option 1)
J.JA   JA   Conjoiner JA

ᴍᴍ
ᴍᴍ = ᴍᴍ + ⊙ + ᴍᴍ (option 2)
J.JA   JA   Conjoiner JA

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

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

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

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

(d.) Ligating Special Characters

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

Consonants and semi-vowels in most cases have a corresponding below-base forms that look similar to the independent consonant/semi-vowel that sits vertically centred below the base character (ᴍ). These characters form vertical conjunct stacks with combining below-base. These below-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 as a fall-back where the ligature forms are not available.

ᴊʜ
ɴᴀ = ᴊʜᴀ + ⊙ + ɴᴀ
JH.NA   JHA   Conjoiner NA

Consonants/semi-vowels can combine horizontally, vertically or have a combination of both in Tulu-Tigalari. Sometimes the same conjunct can have both these ways of ligating as seen above in the case of J.JA. 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).

ᴋᴛᴀ = ᴋᴀ + ⊙ + ᴛᴀ
K.TA   KA   Conjoiner TA

ɴɴᴀ
ɢᴀ = ɴɴᴀ + ⊙ + ɢᴀ
NN.GA   NNA   Conjoiner GA

There are always exceptions to these general patterns :

ʟʟ
ʟʟᴀ = ʟʟᴀ + ⊙ + ʟʟᴀ
LL.LLA   LLA   Conjoiner LLA

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

$$\text{C.CA}^{18} \quad = \quad \text{CA} \quad + \quad \text{Conjoiner} \quad + \quad \text{CA}$$

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 ligatures.

$$\text{K.S.SA} \quad = \quad \text{KA} \quad + \quad \text{Conjoiner} \quad + \quad \text{SA} \quad + \quad \text{Conjoiner} \quad + \quad \text{SA}$$

TULU-TIGALARI LETTER MA, TULU-TIGALARI LETTER YA, TULU-TIGALARI LETTER RA, TULU-TIGALARI LETTER LA & TULU-TIGALARI LETTER VA usually form ligatures with the characters they are combing with. They have combining post-base forms that are unrelated to their parent forms.

$$\text{K.MA} \quad = \quad \text{KA} \quad + \quad \text{Conjoiner} \quad + \quad \text{MA}$$

$$\text{K.YA} \quad = \quad \text{KA} \quad + \quad \text{Conjoiner} \quad + \quad \text{MA}$$

$$\text{K.RA} \quad = \quad \text{KA} \quad + \quad \text{Conjoiner} \quad + \quad \text{RA}$$

$$\text{K.LA} \quad = \quad \text{KA} \quad + \quad \text{Conjoiner} \quad + \quad \text{LA}$$

$$\text{K.VA} \quad = \quad \text{KA} \quad + \quad \text{Conjoiner} \quad + \quad \text{VA}$$

The semi-vowel signs mentioned above, that attach below the baseline in a conjunct cluster combine with the final character.

$$\text{S.S.VA} \quad = \quad \text{SA} \quad + \quad \text{Conjoiner} \quad + \quad \text{SA} \quad + \quad \text{Conjoiner} \quad + \quad \text{VA}$$

---

18   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.

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

ഇ്ഞ്ജ് = ⓐ + ⊙ + ഷ + ⊙ + ണ + ⊙ + യ
K.SS.NN.YA   KA   Conjoiner   SSA   Conjoiner   NNA   Conjoiner   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, UU[19], Vocalic R & Vocalic RR combine with below 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.

ⓚⓚ = ⓚ + ⊙ + ⓚ + ◡
K.KU   KA   Conjoiner   KA   U-v.s.

ഷ്ക്രു = ഷ + ⊙ + ⓚ + ◯
SS.KRU   SSA   Conjoiner   KA   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 *Looped Virama* and *Repha* with a select few characters and conjuncts :

The *Looped Virama* ligatures are formed with :
K (ⓚ൪), G (ⓖ൪), N (൬), T (ⓣ൪) & TT (൮/ ൮)

And few conjuncts like :
K.K ⓚⓚ൪, K.N ⓚ൪, K.T ⓚⓣ൪, K.TT ⓚ൮, TT.TT ൮, T.T ⓣⓣ൪ , T.K ⓣⓚ൪, T.N ⓣ൪, N.N ൬,
N.T ൬൪, N.TT ൬
(*Refer Section 5.4.c*)

Repha ligatures are formed with letters :
R.MA ൰ / ൰, R.YA ൴ & R.VA ൵/൵
(*Refer Section 5.5.c*)

───────────

(d.)   **Ligating Special Characters :**

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

$$ ഌ̈ = ◌̇ + ഩ + ◌ᵢ + ◌̆ $$

```
R.K(ə:)      Repha     KA      AA-v.s.    Virama
```

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

```
Repha (◌̇) → Consonant (ഡ) → Vowel (◌ᵢ) → Virama (◌̆) = ഡᵢ̈
```

5.7   *Visarga, Candra Anunasika, Anusvara*

```
Visarga              ◌ः
Candra Anunasika     ◌ᴗ
Anusvara             ◌ం
```

The *Candra Anunasika* mark (◌ᴗ) is analogous to the *Candrabindu* found in other Indic scripts. 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, Section 5.2, Comments on encoding the Tigalari script - Srinidhi A and Sridatta A[20]. This character can combine with all letters and vowel signs.

```
ഩᴗ      =   ഡ   +   ◌ᵢ   +   ◌ᴗ
≃KÕ         KA       OO-v.s.  andra anunasika
```

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

```
ഡం      =   ഡ   +   ◌ం
KAṀ         KA       anusvara(Ṁ)
```

─────────

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

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

ഐः   =   ഐ   +   ◌ः
KAḤ   KA   visarga(Ḥ)

5.8 *Avagraha*

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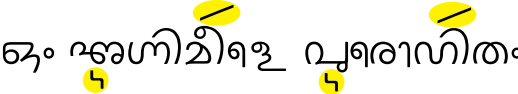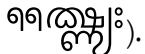
5.9 Vedic Tone Marks

Svarita   ◌́

Anudatta   ◌̥

Tulu-Tigalari manuscripts have many Vedic marks [21]. 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.[22]

To illustrate its use :

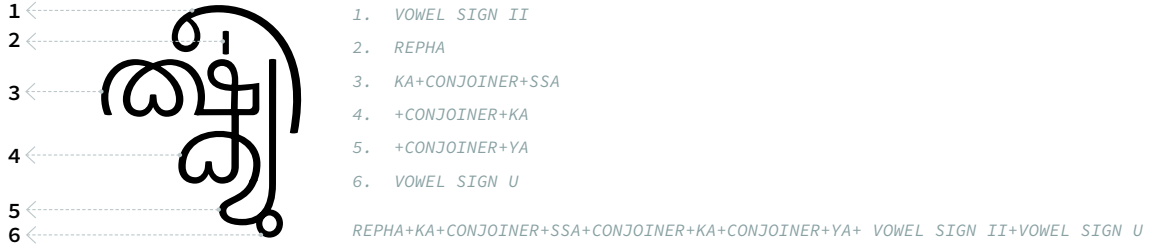ഓം ഇഗ്നിമീരെ വുരൊഹിതം

Oṁ a̱gnimī̱le pu̱rohitaṁ

5.10 Vertical metrics

Tulu-Tigalari is seen to have a maximum of six characters in a cluster (Eg.:). 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 Latin 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.

---

21   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

22   *Udatta* is generally left unmarked.

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 an example of this using a hypothetical cluster :

```
1.  VOWEL SIGN II
2.  REPHA
3.  KA+CONJOINER+SSA
4.  +CONJOINER+KA
5.  +CONJOINER+YA
6.  VOWEL SIGN U

REPHA+KA+CONJOINER+SSA+CONJOINER+KA+CONJOINER+YA+ VOWEL SIGN II+VOWEL SIGN U
```

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.

6.1   Alternate Glyph Shapes

Tulu-Tigalari is non-standardized and therefore, multiple alternate forms of glyphs are found. This has been documented in the supplementary paper titled, 'A list of common Tulu-Tigalari conjuncts, L2/21-211'. The glyph shapes employed within a manuscript tend to remain the same and do not switch to their alternate forms. We find the alternate shapes to appear in sets (as seen grouped together in letters A, AA & O, OO).

We recommend handing the rare forms of vowels letters II (ଗୁ , ଗୁ) and UU (ଗୁ , ଗୁ) as sequences as mentioned in section 5.2.1. The other forms can be handled at the font level as glyphic variants.

Tulu-Tigalari vowels with alternate forms. The first glyph (from the left) in the list below is the default form. :

```
TULU-TIGALARI LETTER A (a)                     ௮ఴ஭    |  ௭ఴ஭  |  ௰ఴ஭

TULU-TIGALARI LETTER AA (ā)                    ௮ఴౘ ௮ఴஆ  |  ௭ఴౘ  |  ௰ఴౘ ௰ఴஆ

TULU-TIGALARI LETTER II (ī)²³                  ௭ఴౠ ௭ఴౡ
```

23   The rare form of Tulu-Tigalari Letter II : ∘O∘ is being examined by the authors and not included in this proposal as it can be updated at a later date.

TULU-TIGALARI LETTER UU (ū)

TULU-TIGALARI LETTER VOCALIC RR (r̥̄)

TULU-TIGALARI LETTER VOCALIC LL (l̥̄)

TULU-TIGALARI LETTER EE (ee)

TULU-TIGALARI LETTER AI (ai)

TULU-TIGALARI LETTER OO (ō)

TULU-TIGALARI LETTER AU (au)

TULU-TIGALARI VOWEL SIGN U & TULU-TIGALARI VOWEL SIGN UU have varying shapes depending on the glyphs they combine with (Refer Section 5.2.d) . The varying shapes seen below belong to the same stylistic set and are not alternate shapes as is the case with the other characters listed above :

TULU-TIGALARI VOWEL SIGN U (u)

TULU-TIGALARI VOWEL SIGN UU (ū)

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

TULU-TIGALARI VOWEL SIGN VOCALIC RR (r̥̄)

Consonants and their corresponding below-base/post-base forms look similar in most cases. The alternate forms of Consonants and their corresponding below-base/post-base forms are listed below :

	CONSONANTS	POST/BELOW−BASE FORMS
TULU-TIGALARI LETTER KHA (kha)		
TULU-TIGALARI LETTER GHA (gha)		
TULU-TIGALARI LETTER CHA (cha)		
TULU-TIGALARI LETTER JHA (jha)		
TULU-TIGALARI LETTER NYA (ña)		
TULU-TIGALARI LETTER DDA (ḍa)		
TULU-TIGALARI LETTER DDHA (ḍha)		
TULU-TIGALARI LETTER DA (da)		
TULU-TIGALARI LETTER BHA (bha)		

TULU-TIGALARI LETTER MA (ma)	� ౭ ౫	౨ ౩ ౨౩ ౭ ౫
TULU-TIGALARI LETTER RA (ra)[24]	౧ 0	౧
TULU-TIGALARI LETTER VA (ma)	౮ ౮౹	౮ ౮౹ ౮౹
TULU-TIGALARI LETTER LLA (ḷa)	౩ ౩	౩ ౩
TULU-TIGALARI LETTER RRA (r̠a)	౪౯ ౪౮	౪౯ ౪౮
TULU-TIGALARI LETTER LLLA (r̠a)	౪౯ ౬౮	౪౯ ౬౮

Repha forms a ligature with letters MA (ࢤ / ࢥ), YA (ࢦ) & VA (ࢧ/ࢨ); discussed under Section 5.5.c.

---

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:

O – U+0CE6

∩ – U+0CE7

౨ – U+0CE8

౩ – U+0CE9

౪ – U+0CEA

౫ – U+0CEB

౬ – U+0CEC

౭ – U+0CED

౮ – U+0CEE

౯ – 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.

---

24   The rare form of Tulu-Tigalari Letter RA that looks like an oval is being examined by the authors in stone inscriptions. Details about this alternate form can be updated at a later date.

8   Other / Symbols / Punctuations

Pushpika   ⟨symbol⟩ ⟨symbol⟩

Dandas | , ||

8.1   *Pushpika*

There are various symbols that are commonly used in Tulu-Tigalari manuscripts which are collectively referred to as *Pushpika* or *Alankaara*[25]. 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 *Pushpikas* in Tulu-Tigalari manuscripts are :

Om Pushpika   ⟨symbol⟩

Shrii Pushpika   ⟨symbol⟩

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 :

⟨symbols⟩	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.
⟨symbols⟩	Can indicate end of a sentence/paragraph/verse
⟨symbols⟩	Can indicate end of a sentence/paragraph/verse
⟨symbols⟩	Can indicate end of or the beginning of a sentence/paragraph/verse.

---

25   Tulu-Tigalari manuscripts have several symbols that appear decorative. These symbols have not been studied closely and might be worth examining. Similar symbols also appear across many Brahmic script systems as-well.

Om Pushpika (ꩰ) :

This *Pushpika* symbol seems to be a stylised Tulu-Tigalari *Om* [26]. Similar to Shrii Pushpika, Om has 2 forms as illustrated below. Both the forms appear within the same manuscript. While form 1 is used exclusively to indicate the sound OM, form 2 can be used additionally 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.   ꩰ°   =   ꩰ   +   ◌ੰ°

      OM   OO   Anusvara

2.   ꩰ

Shrii Pushpika (ꩱ) :

The *Shrii* ligature in Tulu-Tigalari has two forms as illustrated below under 1 &2. It is to be noted that the *Shrii Pushpika* resembles the *Shrii* ligature. Various forms of *Pushpika* are found with dramatic flourishes (Refer Figure 24).

1.   ꩱ   =   ꩲ   +   ◌̆   +   ꩳ   +   ◌ꩴ

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

2.   ꩱ

Though the *Pushpika* characters may superficially resemble the phonetic syllables, these are used as space fillers and for other decorative purposes. Hence, they have be been categorized as punctuation characters with the character property *Po* and have been proposed as separate characters due to their semantics and function.

8.2 *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.

8.3 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 the Tulu-Tigalari script.

---

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

9   Script Behaviour Summary

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

ഩ̆	=	ഩ	+	̆
K(ⱺ)		KA		virama

The Looped Virama character is used to call the Virama ligatures that form with KA ഩ6, GA ౮6, TTA ⅄/ ᵍ, TA ഩ6 & NA ൻ

ഩ6	=	ഩ	+	⸋6
K		KA		L.Vir

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 cluster. The Conjoiner character is used to create ligatures :

ഩ	=	ഩ	+	⊕	+	62⌡
K.KHA		KA		Conjoiner		KHA

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 the final consonant in a conjunct.

ഩ	=	ഩ	+	⊕	+	62⌡	+	⸋)
K.KHII		KA		Conjoiner		KHA		II-v.s.
		>K + A		-A		>KH + A		-A + II

A few vowel signs reorder to appear before a consonant/conjunct :

ﻉഩ	=	ഩ	+	ﻉ◌
KEE		KA		EE-v.s.

ﻉﻉഩ	=	ഩ	+	ﻉﻉ◌
KAI		KA		AI-v.s.

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

ﻉഩŋ	=	ഩ	+	ﻉ◌ŋ
KAU		KA		AU-v.s.

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

ⓦ   =   ◌   +   ⓦ
R.KA   Reph   KA

The Reph forms a conjunct with consonants—MA ⅀ / ⅀ , YA ∂⩔ & VA ∩⩔/∩Ⴘ.

∂⩔   =   ◌   +   ∂
R.YA   Reph   YA

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

Kannada numeral system is recommend to be used 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.

Tulu-Tigalari

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

10 Implementation

INDEPENDENT VOWELS :

11380   �ൂ TULU-TIGALARI LETTER A

11381   ൪ൂ TULU-TIGALARI LETTER AA

11382   ൬__ TULU-TIGALARI LETTER I

11383   ൬ൗ TULU-TIGALARI LETTER II

        ≡ 11382 ൬__ 113C9 ◌ൗ

11384   ൦__ TULU-TIGALARI LETTER U

11385   ൦ൕ TULU-TIGALARI LETTER UU

        ≡ 11384 ൦__ 113BB ◌ൡ

11386   ൭ TULU-TIGALARI LETTER VOCALIC R

11387   ൮ TULU-TIGALARI LETTER VOCALIC RR

11388   ൯ TULU-TIGALARI LETTER VOCALIC L

11389   ൰ TULU-TIGALARI LETTER VOCALIC LL

1138A   --- <<RESERVED FOR E>>

1138B   ൱ TULU-TIGALARI LETTER EE

1138E   ൲ TULU-TIGALARI LETTER AI

        ≡ 1138B ൱ 113C2 ൳◌

1138F   --- <<RESERVED FOR O>>

11390   ൴ TULU-TIGALARI LETTER OO

11391   ൵ TULU-TIGALARI LETTER AU

        ≡ 11390 ൴ 113C9 ◌ൗ

CONSONANTS :

11392   ൬ TULU-TIGALARI LETTER KA

11393   ൶ TULU-TIGALARI LETTER KHA

11394   ൷ TULU-TIGALARI LETTER GA

11395	ഢ	TULU-TIGALARI LETTER GHA
11396	ങ	TULU-TIGALARI LETTER NGA
11397	ച	TULU-TIGALARI LETTER CA
11398	ഝ	TULU-TIGALARI LETTER CHA
11399	ജ	TULU-TIGALARI LETTER JA
1139A	ഝ	TULU-TIGALARI LETTER JHA
1139B	ഞ	TULU-TIGALARI LETTER NYA
1139C	ട	TULU-TIGALARI LETTER TTA
1139D	ഠ	TULU-TIGALARI LETTER TTHA
1139E	ഡ	TULU-TIGALARI LETTER DDA
1139F	ഢ	TULU-TIGALARI LETTER DDHA
113A0	ണ	TULU-TIGALARI LETTER NNA
113A1	ത	TULU-TIGALARI LETTER TA
113A2	ഥ	TULU-TIGALARI LETTER THA
113A3	ദ	TULU-TIGALARI LETTER DA
113A4	ധ	TULU-TIGALARI LETTER DHA
113A5	ന	TULU-TIGALARI LETTER NA
113A6	പ	TULU-TIGALARI LETTER PA
113A7	ഫ	TULU-TIGALARI LETTER PHA
113A8	ബ	TULU-TIGALARI LETTER BA
113A9	ഭ	TULU-TIGALARI LETTER BHA
113AA	മ	TULU-TIGALARI LETTER MA
113AB	യ	TULU-TIGALARI LETTER YA
113AC	ര	TULU-TIGALARI LETTER RA
113AD	ല	TULU-TIGALARI LETTER LA
113AE	വ	TULU-TIGALARI LETTER VA
113AF	ശ	TULU-TIGALARI LETTER SHA
113B0	ഷ	TULU-TIGALARI LETTER SSA
113B1	സ	TULU-TIGALARI LETTER SA

113B2   ᴍ   TULU-TIGALARI LETTER HA

113B3   ᴈ̲   TULU-TIGALARI LETTER LLA

113B4   ಲ೨   TULU-TIGALARI LETTER RRA

113B5   ೮೨   TULU-TIGALARI LETTER LLLA

113B6   ---   <<RESERVED FOR NNNA>>

OTHER LETTERS :

113B7   ᛋ   TULU-TIGALARI SIGN AVAGRAHA

VOWEL SIGNS :

113B8   ◌ൗ   TULU-TIGALARI VOWEL SIGN AA

113B9   ◌ꞈ   TULU-TIGALARI VOWEL SIGN I

113BA   ◌ꞈ   TULU-TIGALARI VOWEL SIGN II

113BB   ◌̥   TULU-TIGALARI VOWEL SIGN U

113BC   ◌̥   TULU-TIGALARI VOWEL SIGN UU

113BD   ◌̥   TULU-TIGALARI VOWEL SIGN VOCALIC R

113BE   ◌̥   TULU-TIGALARI VOWEL SIGN VOCALIC RR

113BF   ◌̥   TULU-TIGALARI VOWEL SIGN VOCALIC L

113C0   ◌̥   TULU-TIGALARI VOWEL SIGN VOCALIC LL

113C1   ---   <<RESERVED FOR VOWEL SIGN E>>

113C2   ೯◌   TULU-TIGALARI VOWEL SIGN EE

113C5   ೯೯◌   TULU-TIGALARI VOWEL SIGN AI

         ≡ 113C2 ೯◌ 113C2 ೯◌

113C6   ---   <<RESERVED FOR VOWEL SIGN O>>

113C7   ೯◌ൗ   TULU-TIGALARI VOWEL SIGN OO

         ≡ 113C2 ೯◌ 113B8 ◌ൗ

113C8   ೯◌ൗ   TULU-TIGALARI VOWEL SIGN AU

         ≡ 113C2 ೯◌ 113C9 ◌ൗ

VARIOUS SIGNS :

113C9   ◌ꠍ   TULU-TIGALARI AU LENGTH MARK

113CA   ◌ᴗ   TULU-TIGALARI SIGN CANDRA ANUNASIKA

113CB   ---   <<RESERVED FOR ALTERNATE ANUNASIKA>>

113CC   ◌ᵒ   TULU-TIGALARI SIGN ANUSVARA

113CD   ◌ᣞ   TULU-TIGALARI SIGN VISARGA

113CE   ◌̆   TULU-TIGALARI SIGN VIRAMA

113CF   ◌ᩅ   TULU-TIGALARI SIGN LOOPED VIRAMA

113D0   ⊞   TULU-TIGALARI CONJOINER

                  • CREATES CONJUNCTS

113D1   ⃞   TULU-TIGALARI REPHA

113D2   ---   <<RESERVED FOR GEMINATION SIGN>>

PUNCTUATION :

113D4 | TULU-TIGALARI DANDA

113D5   ‖   TULU-TIGALARI DOUBLE DANDA

113D6   ---   <<RESERVED FOR ALTERNATE STOP>>

113D7   ꢨ   TULU-TIGALARI SIGN OM PUSHPIKA

113D8   ꣑   TULU-TIGALARI SIGN SHRII PUSHPIKA

VEDIC CHARACTERS :

113E0   ---   <<RESERVED FOR UDATTA>>

113E1   ◌᷄   TULU-TIGALARI VEDIC TONE SVARITA

113E2   ◌᷊   TULU-TIGALARI VEDIC TONE ANUDATTA

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 < CONJOINER
```

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;11382 113C9;;;;N;;;;;
11384;TULU-TIGALARI LETTER U;Lo;0;L;;;;;N;;;;;
11385;TULU-TIGALARI LETTER UU;Lo;0;L;11384 113BB;;;;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;1138B 113C2;;;;N;;;;;
11390;TULU-TIGALARI LETTER OO;Lo;0;L;;;;;N;;;;;
11391;TULU-TIGALARI LETTER AU;Lo;0;L;11390 113C9;;;;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;113C2 113C2;;;;N;;;;;
113C7;TULU-TIGALARI VOWEL SIGN OO;Mc;0;L;113C2 113B8;;;;N;;;;;
113C8;TULU-TIGALARI VOWEL SIGN AU;Mc;0;L;113C2 113C9;;;;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;Mc;9;L;;;;;N;;;;;
113D0;TULU-TIGALARI CONJOINER;Mn;9;NSM;;;;;N;;;;;
113D1;TULU-TIGALARI REPHA;Lo;0;L;;;;;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;;;;;
113E1;TULU-TIGALARI VEDIC TONE SVARITA;Mn;0;NSM;;;;;N;;;;;
113E2;TULU-TIGALARI VEDIC TONE ANUDATTA;Mn;0;NSM;;;;;N;;;;;
```

10.3 Indic Syllabic 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 ; Pure_Killer # Mn  [2]  TULU-TIGALARI SIGN VIRAMA..TULU-TIGALARI SIGN LOOPED VIRAMA


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


# 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
13B8..113BA  ; Vowel_Dependent # Mc [3] TULU-TIGALARI VOWEL SIGN AA..TIGALARI VOWEL SIGN VOCALIC II
113BB..113C0 ; Vowel_Dependent # Mn [6] TULU-TIGALARI VOWEL SIGN U..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
```

10.4 Indic Positional Category

```
# Indic_Positional_Category=Right
113B8          ; Right # Mc   [3] TULU-TIGALARI VOWEL SIGN AA
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 # Lo        TULU-TIGALARI REPHA
113E1          ; Top # Mn        TULU-TIGALARI VEDIC TONE SVARITA


# Indic_Positional_Category=Bottom
113BB..113C0   ; Bottom # Mn   [6] TULU-TIGALARI VOWEL SIGN U..TULU-TIGALARI VOWEL SIGN VOCALIC LL
113E2          ; Bottom # Mn TULU-TIGALARI VEDIC TONE ANUDATTA


# Indic_Positional_Category=Top_And_Right
113B9..113BA   ; Top_And_Right # Mc   [2] TULU-TIGALARI VOWEL SIGN I..TULU-TIGALARI VOWEL SIGN II
```

11 Similar characters (Confusables)

Tulu-Tigalari script has a few characters that look similar to each other as listed below.

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

1.–		2.–		3.–	
KHA	ఖ / ఖ	E	ఙ	TA	ఠ
CA	౨	BHA	ఊ	NA	౧
PA	౧	HA	౬		
VA	౮	8 (Ti.)	౭		
MA	౨				

4.–		5.–		6.–	
DHA	౩/3	SHA	ఴ	2 (Ti.)	౨
3	3	GA	౧	U	౬
				2	2

7.–		8.–		9.–	
TTA	◌౬	Anusvara	◦	Virama	◌̆
Anudatta	◌౬	0	0	Anunasika	◌ ◡
		0 (Ti.)	O	Repha + Virama	◌̆

10.–		11.–		12.–	
Vocalic R	౪	7 (Ti.)	౬	10 (Ti.)	౹
4 (Kan.)	౪	EE-v.s.	౬◌	DA	�
				DDA	౹/ ౹

13.–		14.–	
3 (Ti.)	౧	GA+Virama	ఴ
I	౧	SHA+Repha	ఴ

12 Script Extensions

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

13 Script_Metadata

Name	Tulu-Tigalari
Size	78
Origin Country	India
Density	1
Likely language	Sanskrit
Lang_Code	san
ID Usage	Exclusion
RTL?	No
LB letters?	No
Shaping req?	Yes
IME?	Yes
Case?	No

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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.
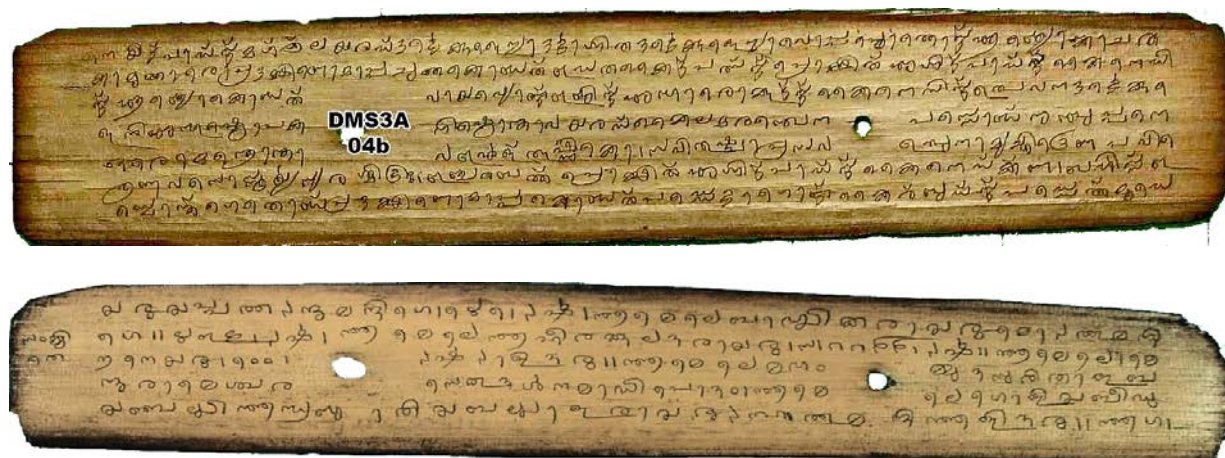
FIGURE 3.
Tulu-Tigalari script, Tulu language (top) and Kannada language (bottom) manuscripts.
SOURCE
(Top) Punyahavidhi, Govind Pai Research Centre, Udupi. (Bottom) Srinidhi A
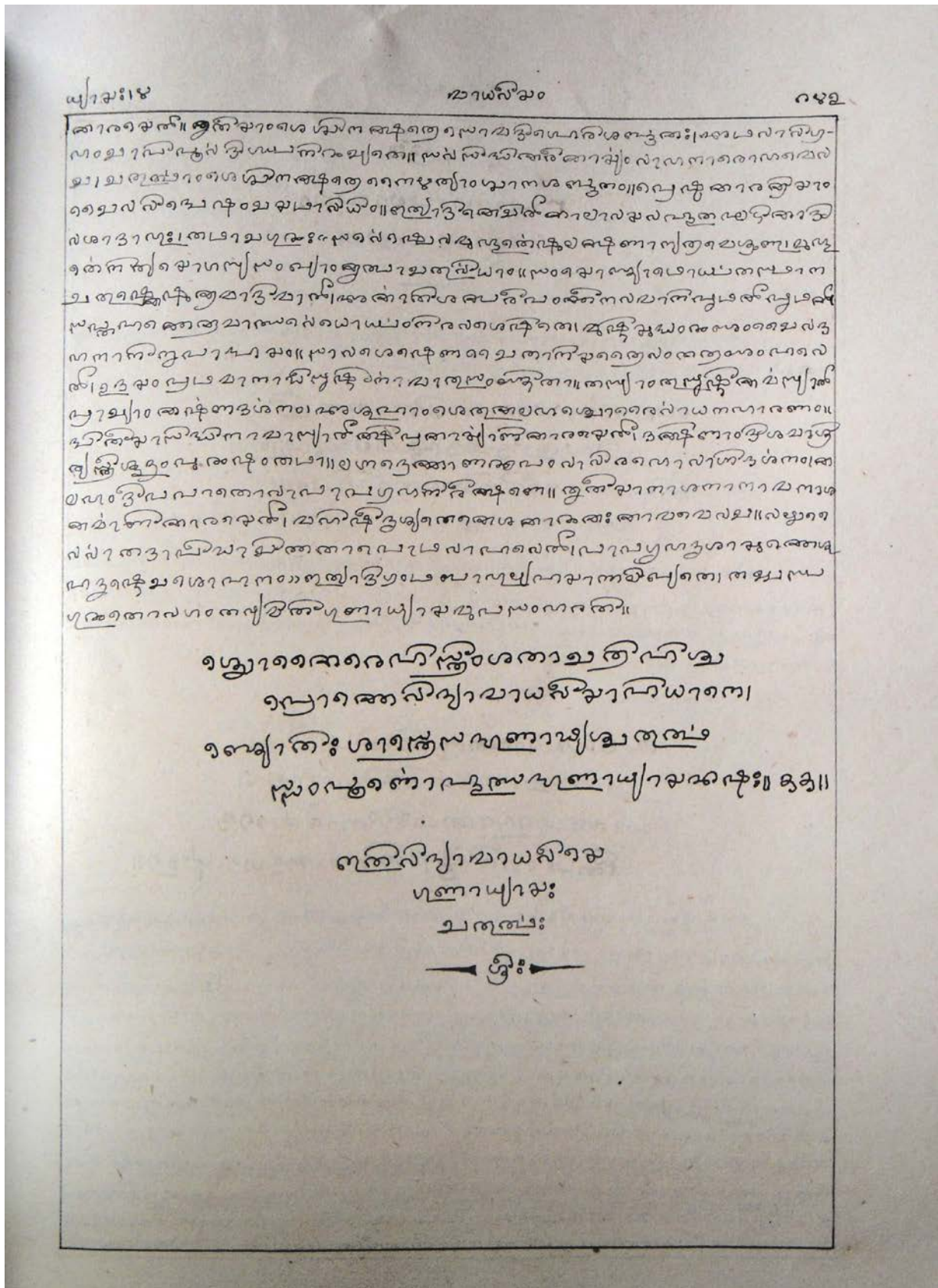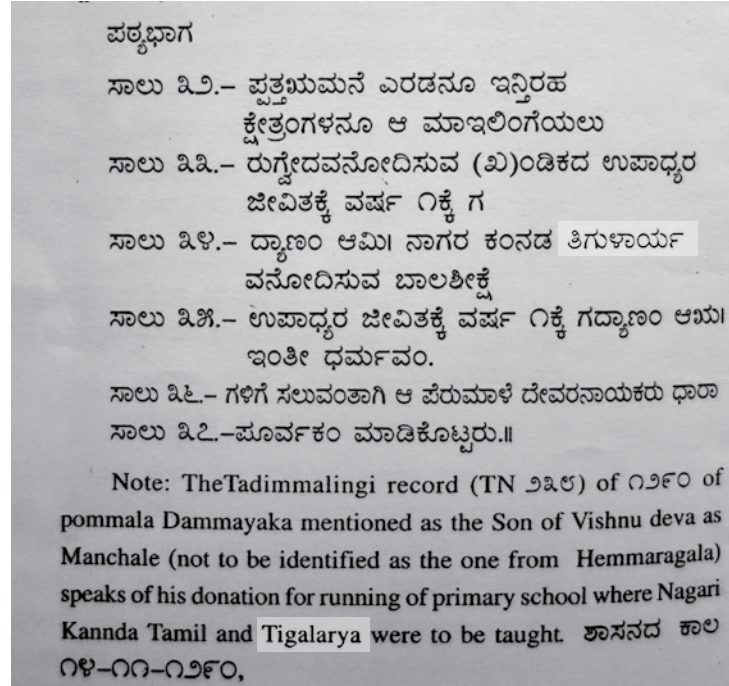
FIGURE 4.
A 20th century paper manuscript in Tulu-Tigalari script.
SOURCE
Dharmasthala Samshodana Pratishtana, Dharmasthala. Handwritten on machine-made paper.

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	ꢂ	ꕞ	അ	ಅ
LETTER AA	ஆ	ꢃ	ꕟ	ആ	ಆ
LETTER I	இ	ꢄ	ꕠ	ഇ	ಇ
LETTER II	ஈ	ꢅ	ꕡ	ഈ	ಈ
LETTER U	உ	ꢆ	ꕢ	ഉ	ಉ
LETTER UU	ஊ	ꢇ	ꕣ	ഊ	ಊ
LETTER VOCALIC R	–	ꢈ	ꕤ	ഋ	ಋ
LETTER VOCALIC RR	–	ꢉ	ꕥ	ൠ	ೠ
LETTER VOCALIC L	–	ꢊ	ꕦ	ഌ	ಌ
LETTER VOCALIC LL	–	ꢋ	ꕧ	ൡ	ೡ
LETTER E	எ	(ꢎ ?)	–	എ	ಎ
LETTER EE	ஏ	ꢏ	ꕨ	ഏ	ಏ
LETTER AI	ஐ	ꢐ	ꕩ	ഐ	ಐ
LETTER O	ஒ	(ꢑ ?)	–	ഒ	ಒ
LETTER OO	ஓ	ꢒ	ꕪ	ഓ	ಓ
LETTER AU	ஔ	ꢓ	ꕫ	ഔ	ಔ
LETTER KA	க	ꢒ	ꕬ	ക	ಕ
LETTER KHA	–	ꢕ	ꕭ	ഖ	ಖ
LETTER GA	–	ꢖ	ꕮ	ഗ	ಗ
LETTER GHA	–	ꢗ	ꕯ	ഘ	ಘ
LETTER NGA	ங	ꢙ	ꕰ	ങ	ಙ
LETTER CA	ச	ꢜ	ꕱ	ച	ಚ
LETTER CHA	–	ꢝ	ꕲ	ഛ	ಛ
LETTER JA	ஜ	ꢝ	ꕳ	ജ	ಜ
LETTER JHA	–	ꢞ	ꕴ	ഝ	ಝ
LETTER NYA	ஞ	ꢟ	ꕵ	ഞ	ಞ
LETTER TTA	ட	ꢠ	ꕶ	ട	ಟ

LETTER TTHA	–	ಂ	ಐ	ಂ	ಠ
LETTER DDA	–	ಒ	ಒ	ಡ	ಡ
LETTER DDHA	–	ಒ	ಒ	ಒ	ಧ
LETTER NNA	ணா	ணா	ണ	ண	ಣ
LETTER TA	த	த	ത	த	ತ
LETTER THA	–	౮	௴	௴	ಥ
LETTER DA	–	౤	ﬡ	ಚ	ದ
LETTER DHA	–	ಚ	ﬡ	ﬡ	ಧ
LETTER NA	ந	ந	ന	ന	ನ
LETTER PA	ப	ொ	வ	ப	ಪ
LETTER PHA	–	ொ	ಷ	ಟ	ಫ
LETTER BA	–	ಬ	ಟ	ಬ	ಬ
LETTER BHA	–	ಐ	ఎ	ಬ	ಭ
LETTER MA	ம	౩	౾	౩	ಮ
LETTER YA	ш	ш	అ	ಯ	ಯ
LETTER RA	ஈ	ஈ	ര	ര	ರ
LETTER RRA	ற	ற	ೞ	೧	ಱ
LETTER LA	ல	௵	ല	ಲ	ಲ
LETTER LLA	ள	ೞ	ೕ	ಳ	ಳ
LETTER LLLA	ழ	ழ	ಲ	ஃ	ೞ
LETTER VA	வ	வ	വ	ವ	ವ
LETTER SHA	௶	௶	ശ	ಶ	ಶ
LETTER SSA	ஷ	ஷ	ಷ	ಷ	ಷ
LETTER SA	ಸ	ಹ	സ	ಸ	ಸ
LETTER HA	ஹ	ஹ	ഗ	ಹ	ಹ
VOWEL SIGN AA	◌ா	◌ா	◌ৗ	◌ం	◌ಾ
VOWEL SIGN I	◌ி	◌ி	◌ী	◌ி	◌ீ
VOWEL SIGN II	◌ீ	◌ீ	◌ী	◌ী	◌ೀ
VOWEL SIGN U	◌ు	◌ా	◌ు	◌ు	◌ు
VOWEL SIGN UU	◌ூ	◌ூ	◌ూ	◌ూ	◌ೂ

	Tamil	Grantha	Tulu-Tigalari	Malayalam	Kannada
VOWEL SIGN VOCALIC R	–	◌ॄ	◌	◌ृ	◌ृ
VOWEL SIGN VOCALIC RR	–	◌ॄ	◌	◌ॄ	◌ॄ
VOWEL SIGN VOCALIC L	–	◌	◌	◌	◌
VOWEL SIGN VOCALIC LL	–	◌	◌	◌	◌
VOWEL SIGN E	ெ◌	◌	–	◌	◌
VOWEL SIGN EE	ே◌	◌	◌	◌	◌
VOWEL SIGN AI	ை◌	◌	◌	◌	◌
VOWEL SIGN O	ொ	◌	–	◌	◌
VOWEL SIGN OO	ோ	◌	◌	◌	◌
VOWEL SIGN AU	ௌ	◌	◌	◌	◌
VIRAMA	◌்	◌	◌	◌	◌
AVAGRAHA	–	ऽ	ऽ	∫	ऽ
REPHA	–	◌̇ / ◌	◌̇	◌̇	◌
0	O	O	O / O	O	O
1	க	க	ॱ / ॱ	௳	ॱ
2	உ	உ	ॱ / உ	ॱ	ॱ
3	ந	ந	ॱ / ॱ	ॱ	ॱ
4	சு	சூ	ॱ / ॱ	ॱ	ॱ
5	ரு	ரு	ॱ / ॱ	ॱ	ॱ
6	சூ	சூ	ॱ / ॱ	ॱ	ॱ
7	எ	எ	ॱ / ॱ	ॱ	ॱ
8	அ	அ	ॱ / ॱ	ॱ	ॱ
9	கூ	கூ	ॱ / ॱ	ॱ	ॱ
10	ய	ய	ॱ0 / ॱ	ॱ	ॱ0
100	௱	௱	ॱ00 / ॱ	ॱ	ॱ00

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
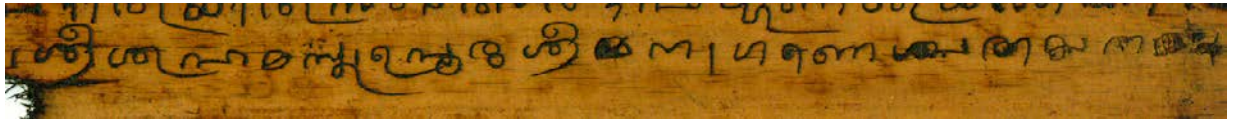
ಶ್ರೀ	ಶ಼ುಬ	ಮ	ಸ್ತು			ಉ	ಪೂ	ರು	ಶ್ರೀ	ಮ	ಹಾಗ	ಗ	ಣೇಶ಼ುರ	ರಾ	ಯ	ನ	ಮಃ	
ಶ್ರೀ	ಶು	ಭ	ಮ	ಸ್ತು		ಉ	ಪೂ	ರು	ಶ್ರೀ	ಮ	ಹಾ	ಗ	ಣೇ	ಶ್ವ	ರಾ	ಯ	ನ	ಮಃ
श्री	शु	भ	म	स्तु		उ	पू	रु	श्री	म	हा	ग	णि	श्व	रा	य	न	मः
Shri	*Shu*	*Bha*	*Ma*	*Stu*	*.*	*U*	*Puu*	*Ru*	*Shri*	*Ma*	*Haa*	*Ga*	*Nnee*	*Shva*	*Raa*	*Ya*	*Na*	*Maha.*

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
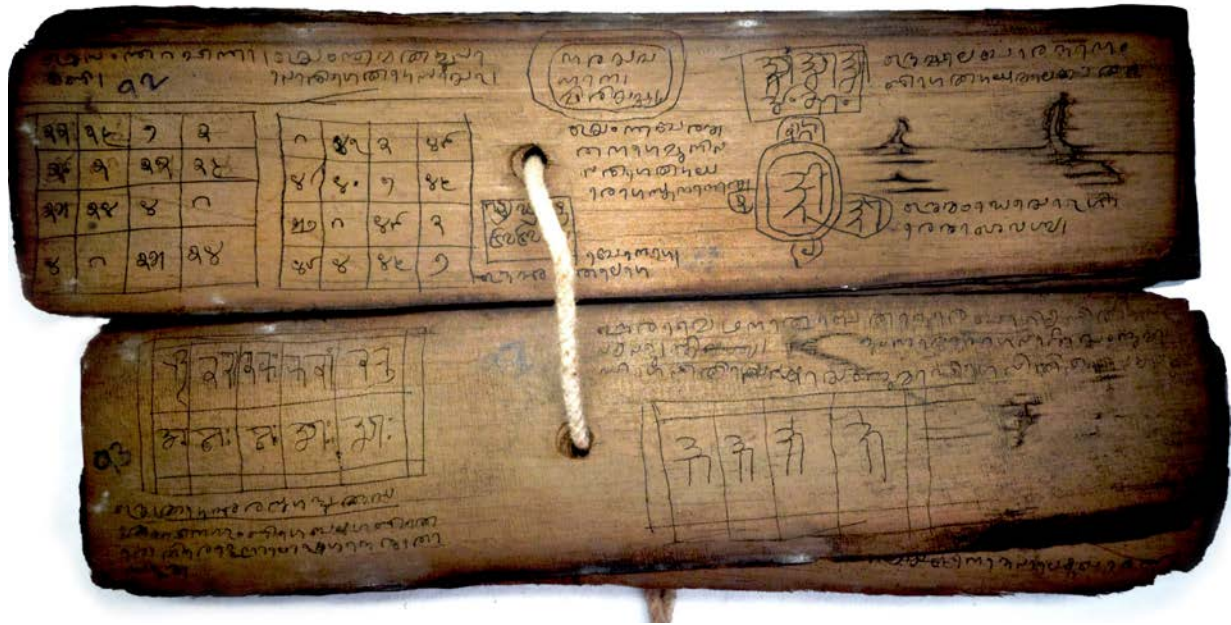
FIGURE 8.3.
A tantric plam leaf manuscript that has Kannada, Nagari and Tulu-Tigalari scripts.
SOURCE
Keladi Museum, Keladi.
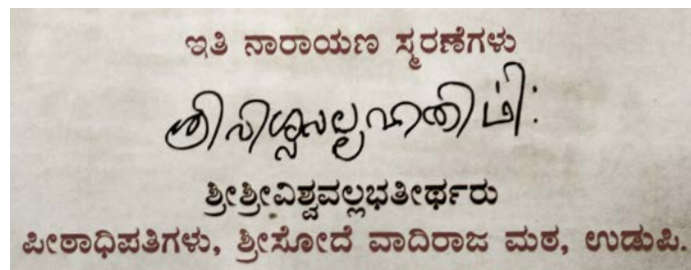
FIGURE 9.
Signature of a prominent seer from Udupi in Tulu-Tigalari that reads 'Shrii Vishwa Vallabha Teertha' of Sōdé Mutt. Rest of the text surrounding it is in Kannada language and script.
SOURCE
Printed on an invitation card.
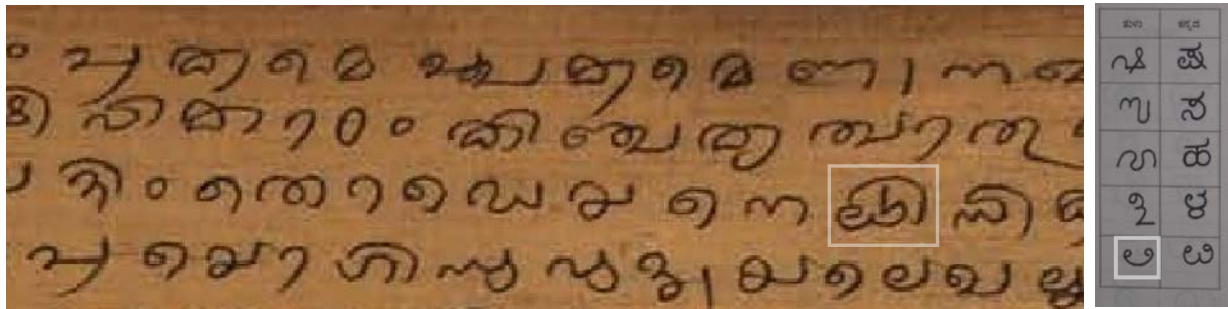
FIGURE 10.

(LEFT)
RRA+I-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, Tuḷu Sahitya Academy, Mangalore.
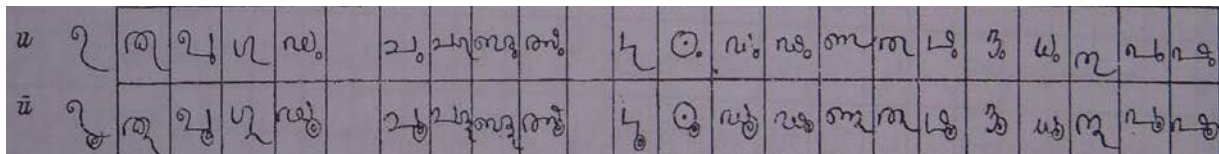
FIGURE 11.
Vowel sign U & UU change according to the character they are combining with.
SOURCE
A C Burnell, Elements of South Indian Palaeography
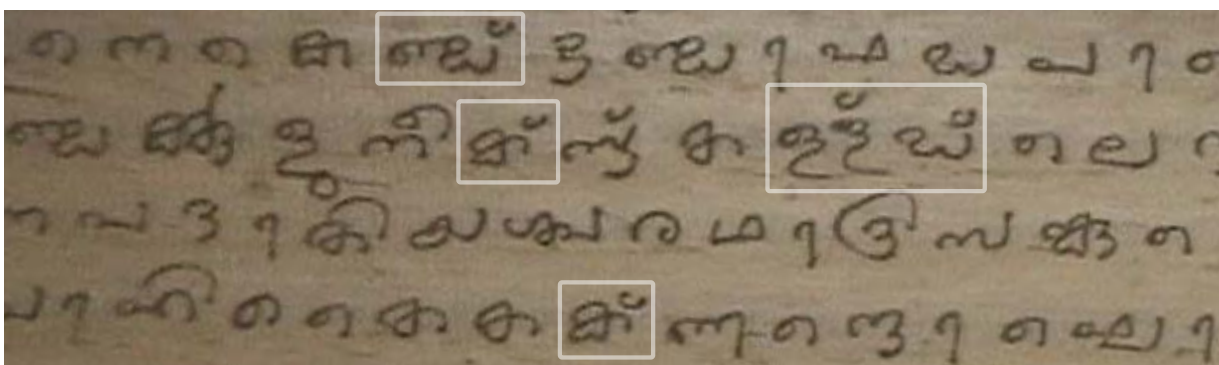
FIGURE 12.
A manuscript of Tuḷu language and Tulu-Tigalari script. Here we see a sequence of letters with *Virama* representing the short un-rounded 'u'.
SOURCE
Dharmasthala Samshodana Pratishtana, Dharmasthala.
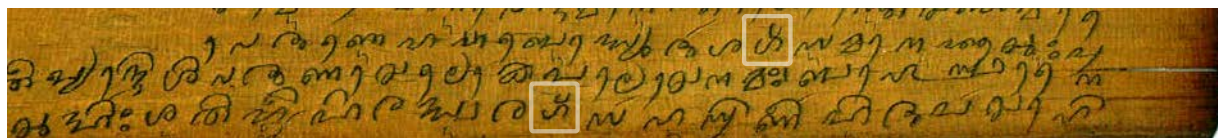
FIGURE 13.
A manuscript of Sanskrit language which uses the semi-circular *Virama* form denoting the negation of the inherent vowel 'A'.
SOURCE
Taraprakashana, Bangalore.
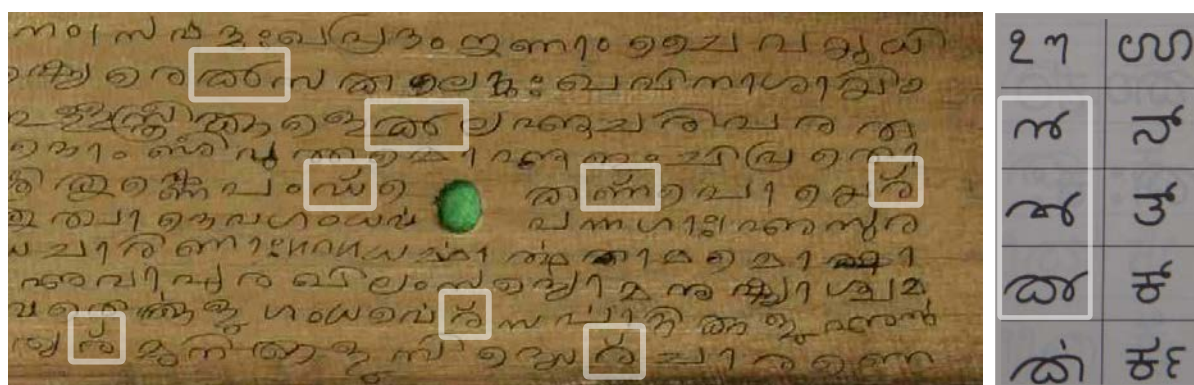
FIGURE 14.
(LEFT)
Both the *Virama* forms seen used in a Tulu language, Tulu-Tigalari script manuscript. Note Ra+*Virama* does not form *Repha*. The combining *Virama* indicates a special vowel that is distinct from a *Repha*.
SOURCE
Anantavruta Kathe, S.A.Krishnaiah, Govinda Pai Research Centre, Udupi

(RIGHT)
Virama ligatures in a Tulu-Tigalari script text book.
SOURCE
Tuḷu Sahitya Academy, Mangalore.
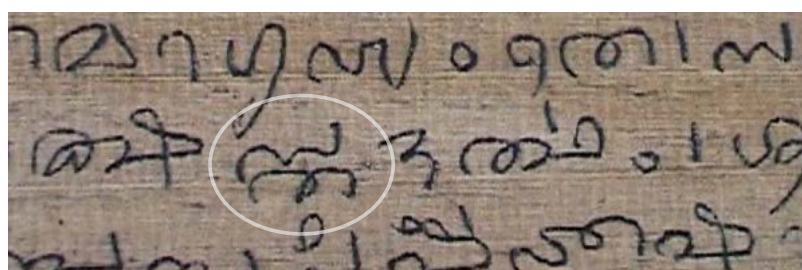
FIGURE 15.
Here, we can see the common practice of drawing below-base forms the same size as the base consonant. It is also interesting to note that most vertical conjuncts shift slightly above the base-line, reducing the interlinear space.
SOURCE
Oriental Research Institute, Mysore.
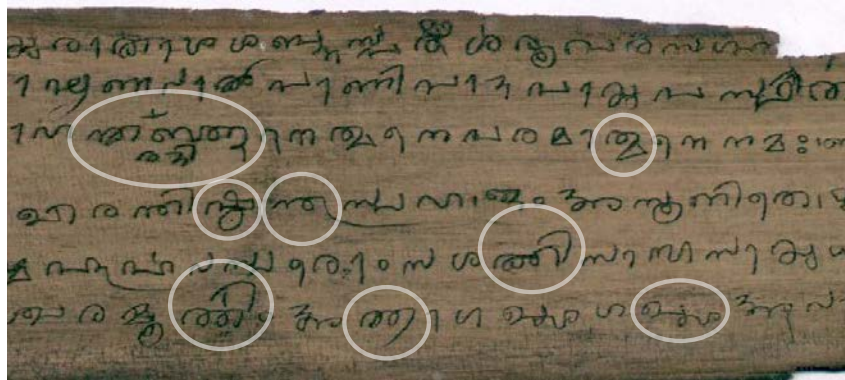
FIGURE 16.
Various forms of ligatures found on a manuscript.
SOURCE
Private collection, Tamil Nadu.
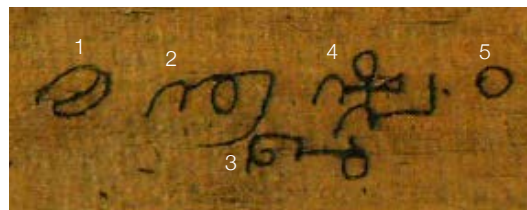
FIGURE 17.
1. Consonant MA,
2. Horizontal Conjunct [NTRA = NA+TA+RA],
3. Consonant + Vowel Sign [PU = PA+U*(v.s.)*],
4. Vertical Conjunct [SSPA = SSA+PA],
5. *Anusvara*. The word reads *Mantrapushpam*.
SOURCE
Private Collection, Puttur.

FIGURE 18.
An example of Vertical Ligature combining with a vowel sign [SSA+KA+Vocalic R].
SOURCE
Private Collection, Bangalore.
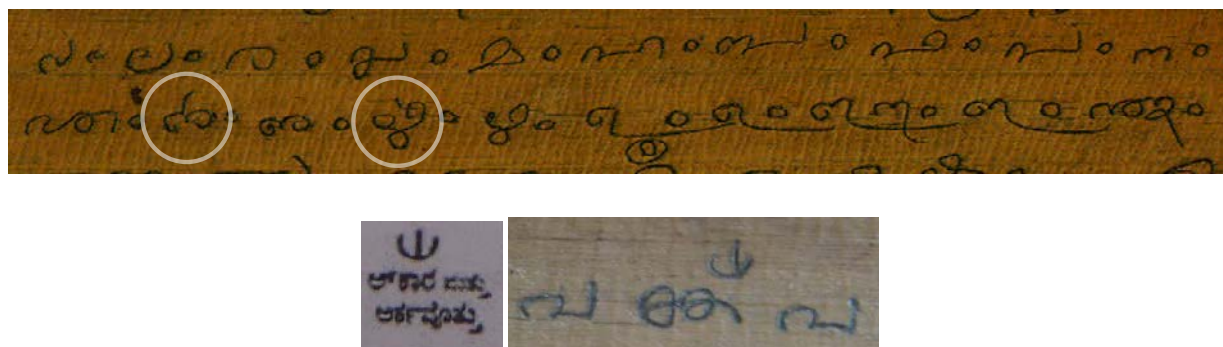
FIGURE 19.

(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 Pratishtana, Dharmasthala.

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 an needs further research. They are not proposed as of now.
SOURCE
Dr S R Vighnaraj, Dharmasthala Samshodana Pratishtana, Dharmasthala. Published by Tulu Sahitya Academy, Mangalore. 2006.
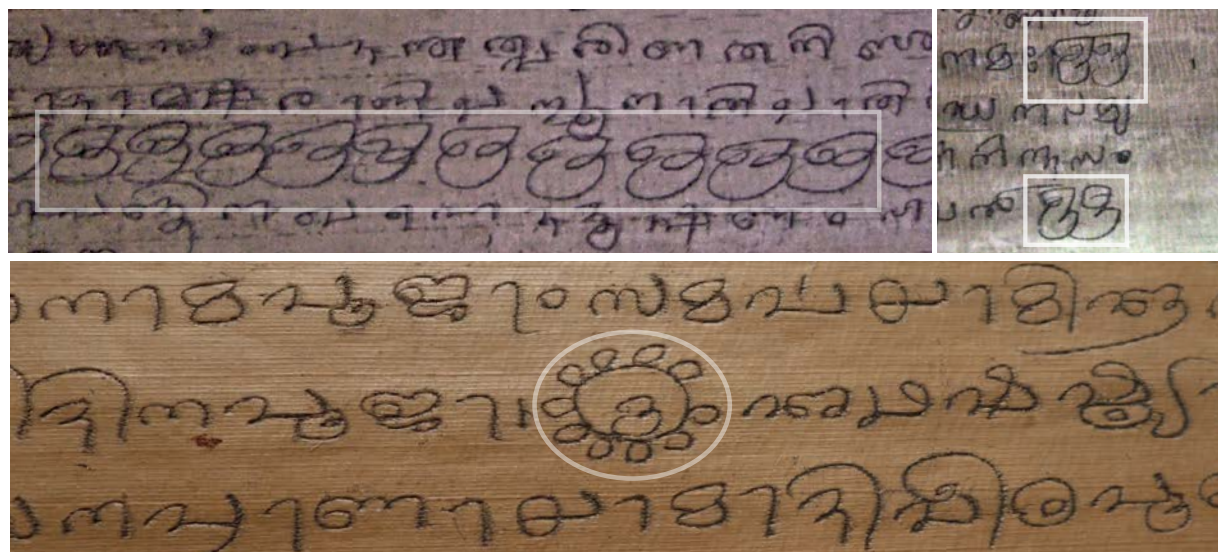
FIGURE 23.
Examples of *Pushpika* '*ʒ*'.
SOURCE
Private collection, Mangalore district.
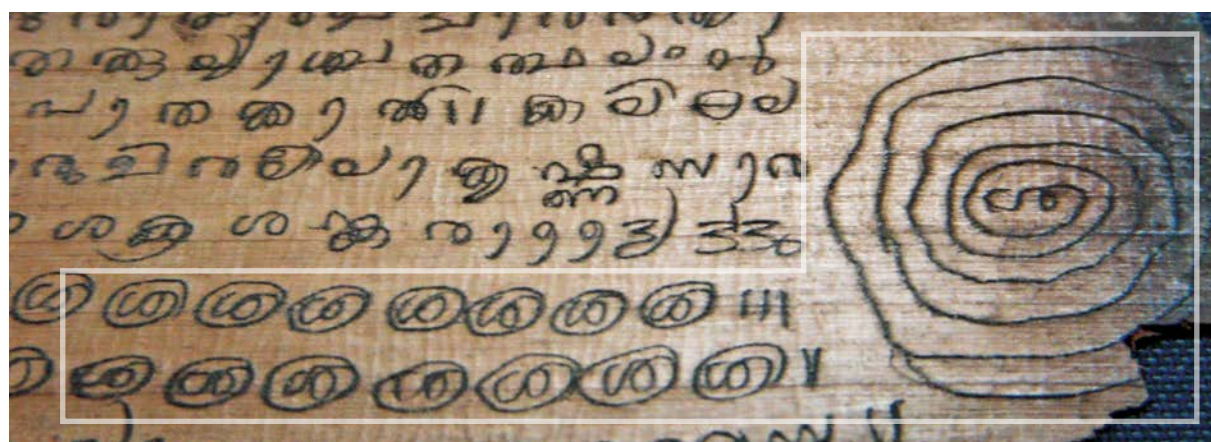
FIGURE 24.
Example of *Shrii* '⟨ⁿ⟩' used as space filler and an ornament.
SOURCE
Private collection, Mangalore district.
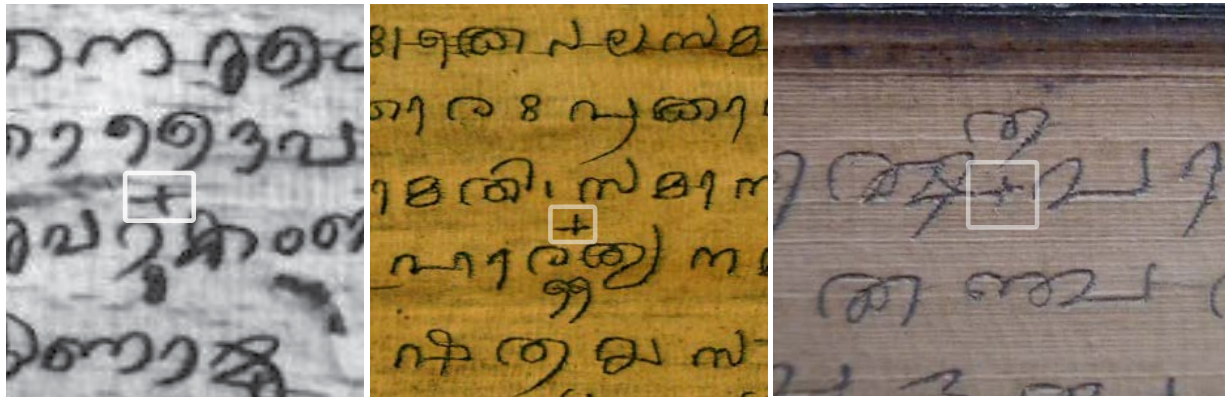
FIGURE 25.

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

SOURCE

Mahaitarayopanishatt Bhashya, Location: Udupi Mutt. Digitised by Taraprakahana, Bangalore.
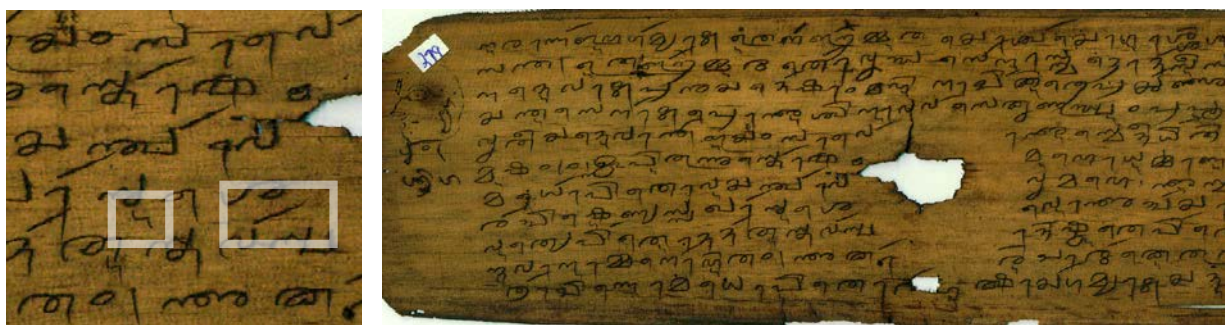
FIGURE 26.

Svarita (◌́) and *Anudatta (◌̖)* are marked in the close-up of the above manuscript (left). They can be

seen used sevral times across the manuscript page (right).

SOURCE

Private collection, Mangalore district.
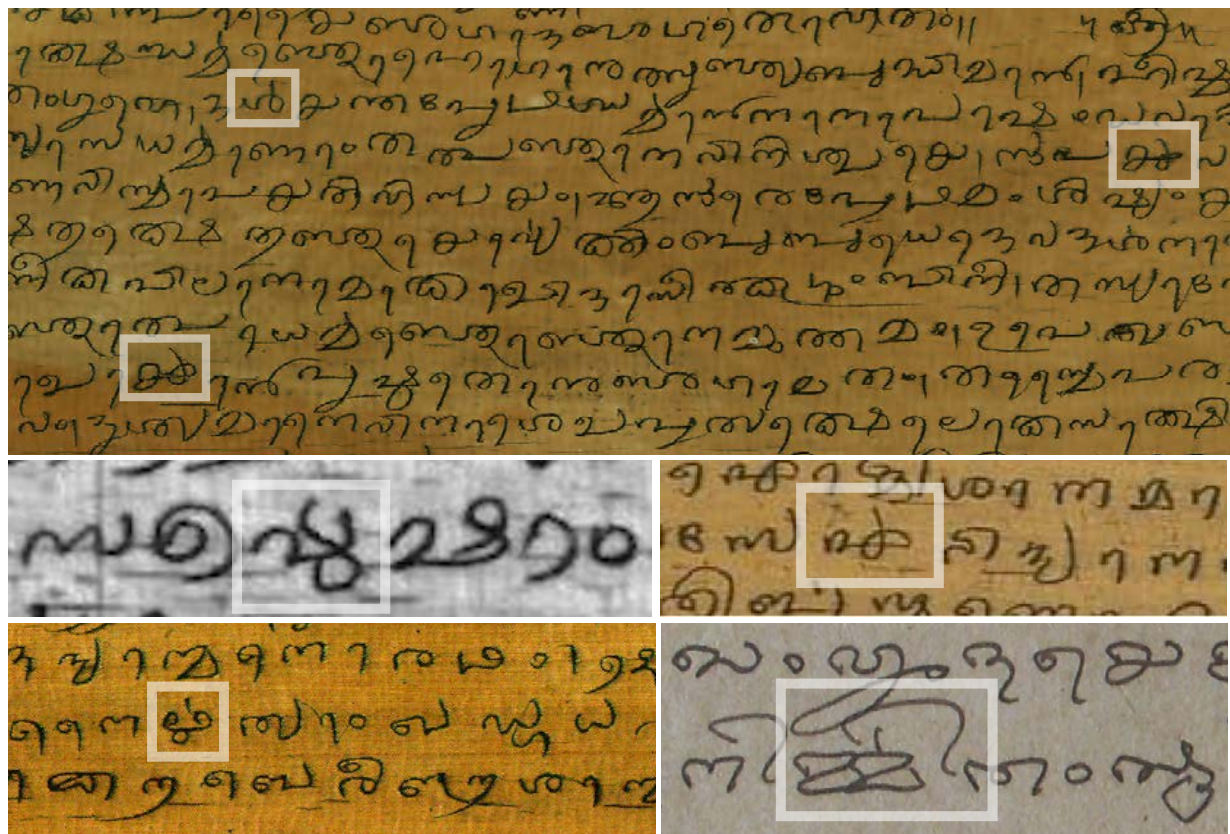
FIGURE 27.

(TOP)

Ligature form YA+*Repha* (ಅ಼). 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 occurance 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* (ನ಼ / ನ಼) ligature fond 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 नैर्ऋत्यां.

SOURCE

Private Collection, Udupi.

(BELOW RIGHT)

[MA+MA]+*Repha*+I

SOURCE

Dharmasthala Samshodana Pratishtana, Dharmasthala.
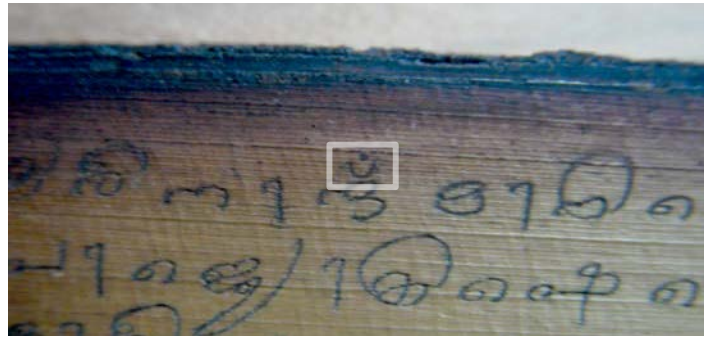
FIGURE 28.
Candrabindu style *Anunasika* character seen used in a Tulu language manuscript. This symbol is used experimentally here in an attempt to indicate the half unrounded U sound which is otherwise associated with a *Candra Virama* form.
SOURCE
Tulu Ramayana, Dharmasthala Samshodana Pratishtana, 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.
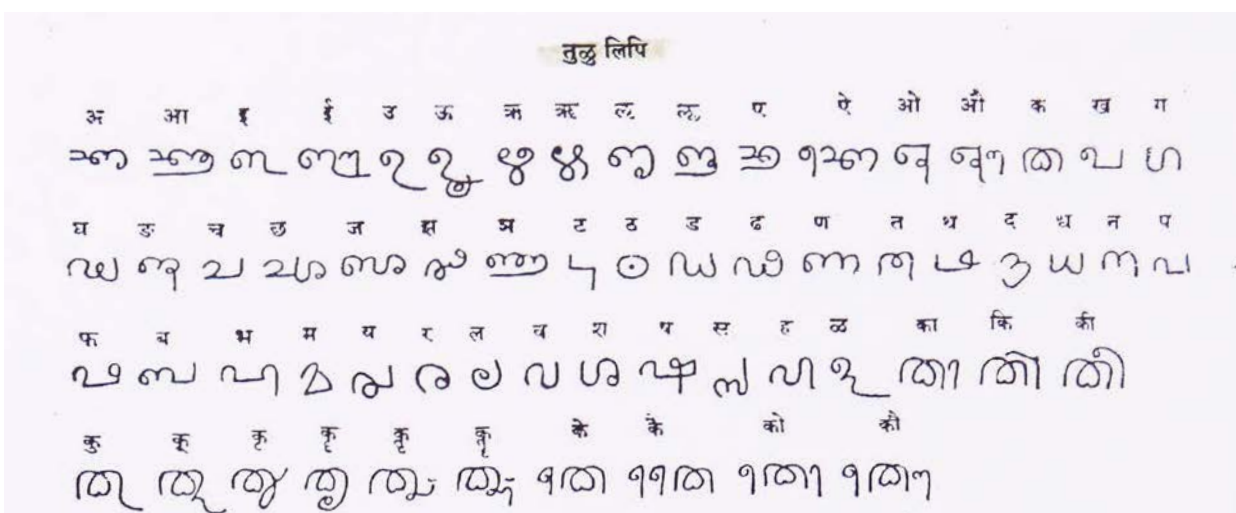
FIGURE 29.
Tulu-Tigalari alphabet
SOURCE
Ojha, Gauri Shankar Hirachand. Bharatiya Prachin Lipimala (The Palaeography of India). Delhi : Munshiram Manoharlal, 1918. Print.

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.
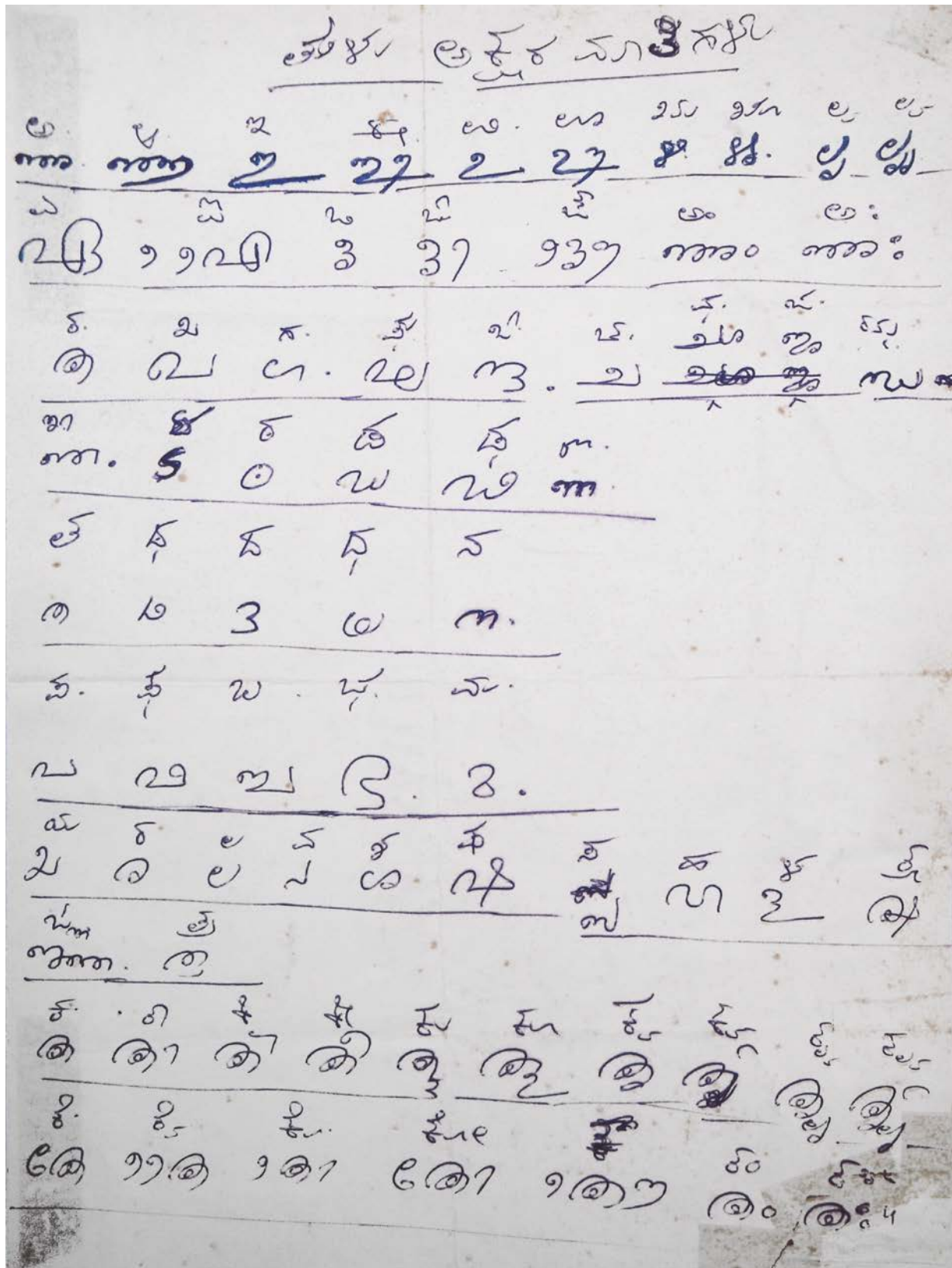
FIGURE 32.
Handwriting Sample of the Tulu-Tigalari character-set and vowel signs.
SOURCE
Poornaprajna Vidyapeetha, Bangalore.
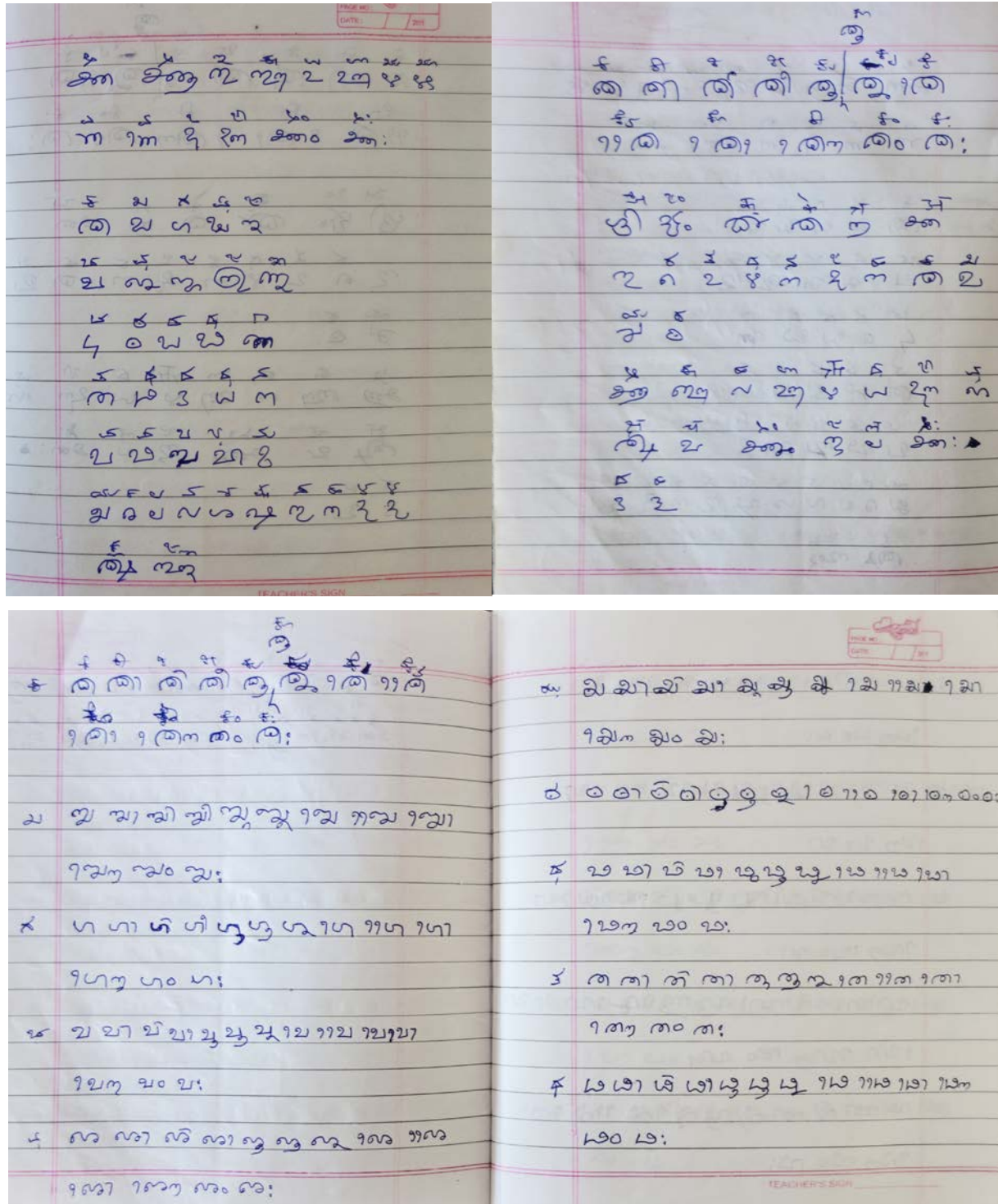
FIGURE 33.

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.
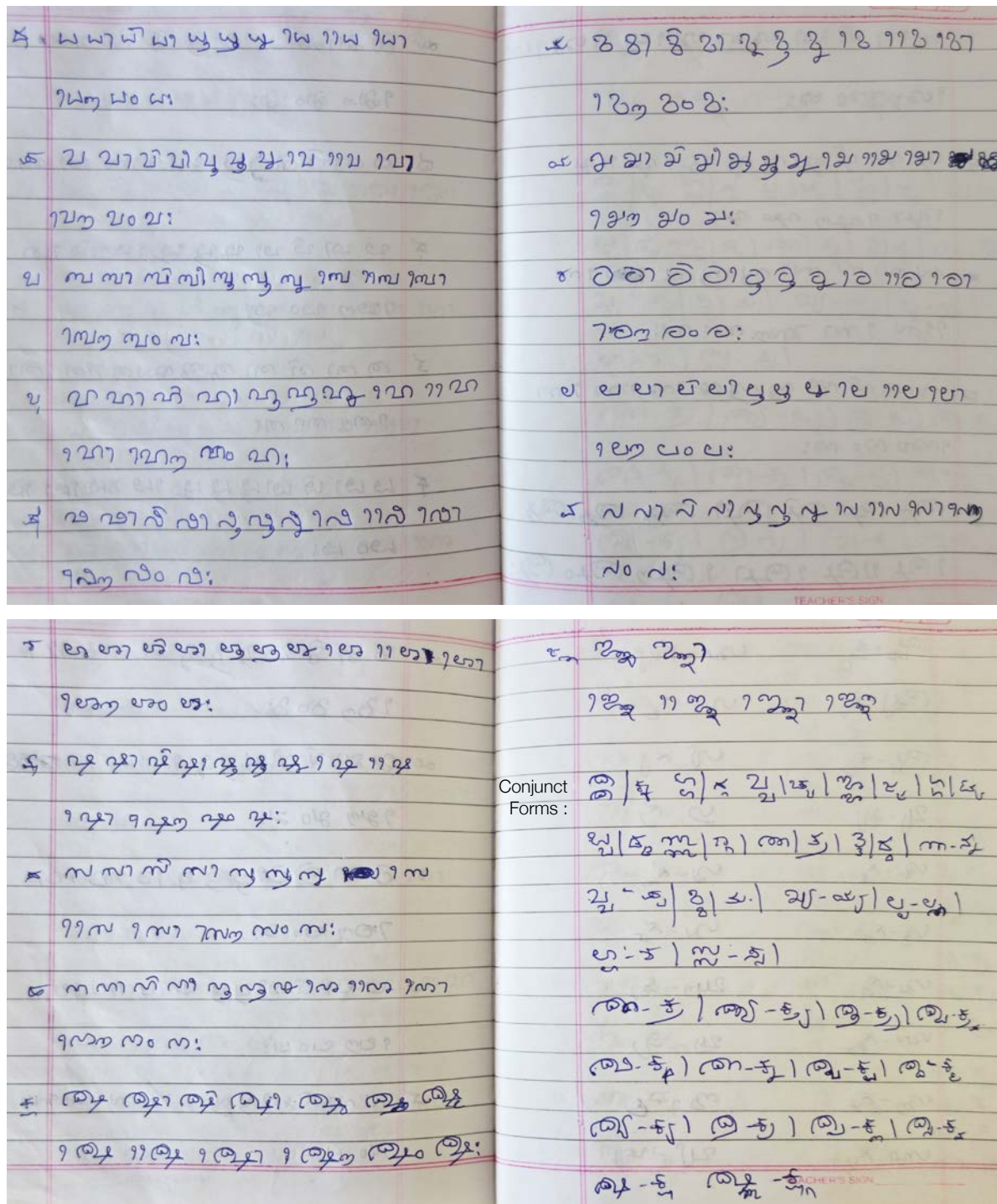
FIGURE 34.
Consonant+Vowel sign combinations and Conjunct forms in Tulu-Tigalari.
SOURCE
From the personal notes of Dr Keladi Venkatesh Jois, Keladi Museum, Keladi.
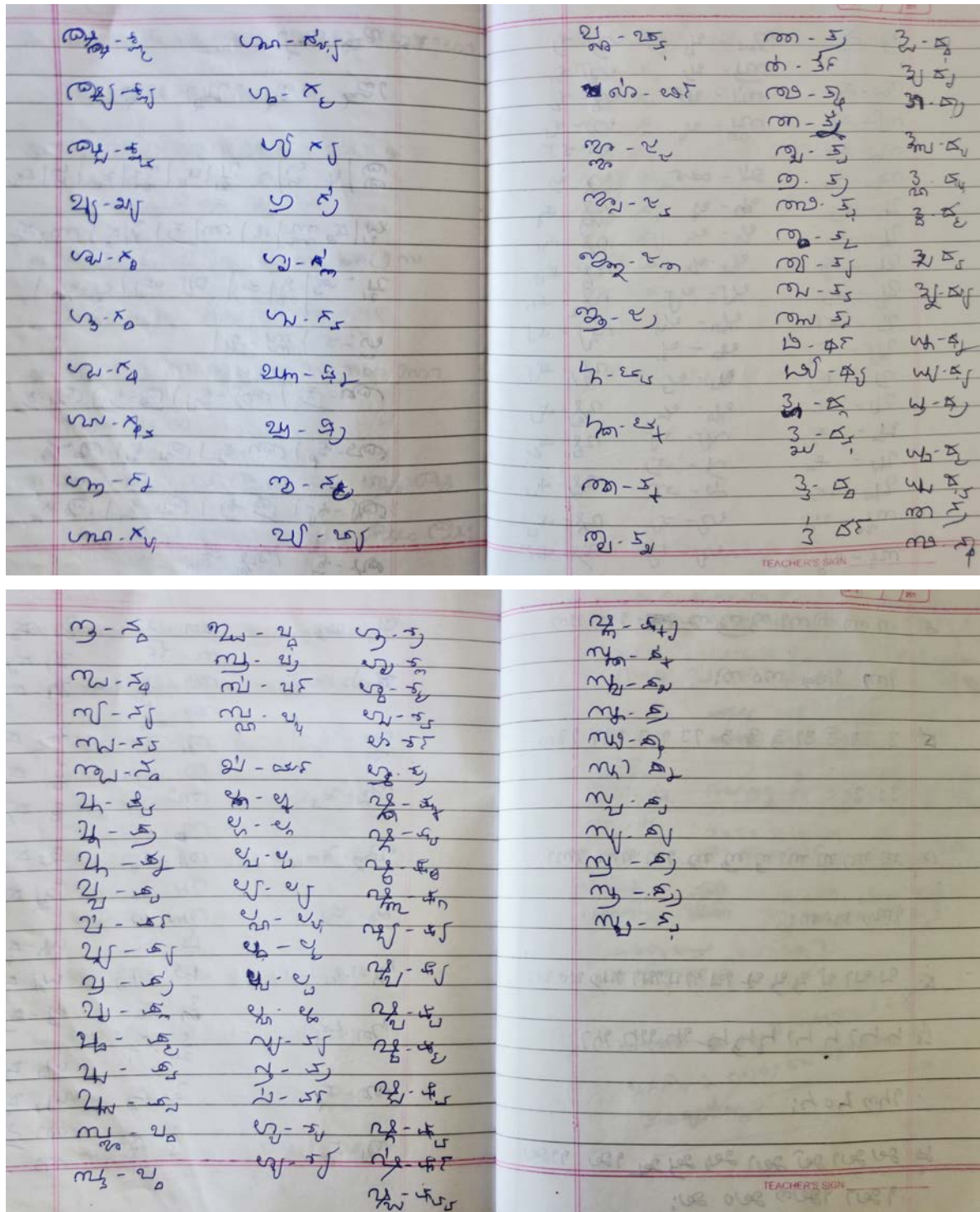
FIGURE 35.
Listing the conjunct forms in Tulu-Tigalari.
SOURCE
From the personal notes of Dr Keladi Venkatesh Jois, Keladi Museum, Keladi.

वर्णमाला

अ आ इ ई उ ऊ ऋ ॠ ऌ

ॡ ए ऐ ओ औ अं अः

similar to

क ख ग घ ङ

च छ ज झ ञ

ट ठ ड ढ ण

त थ द ध न

प फ ब भ म

य र ल व श ष स ह ळ क्ष
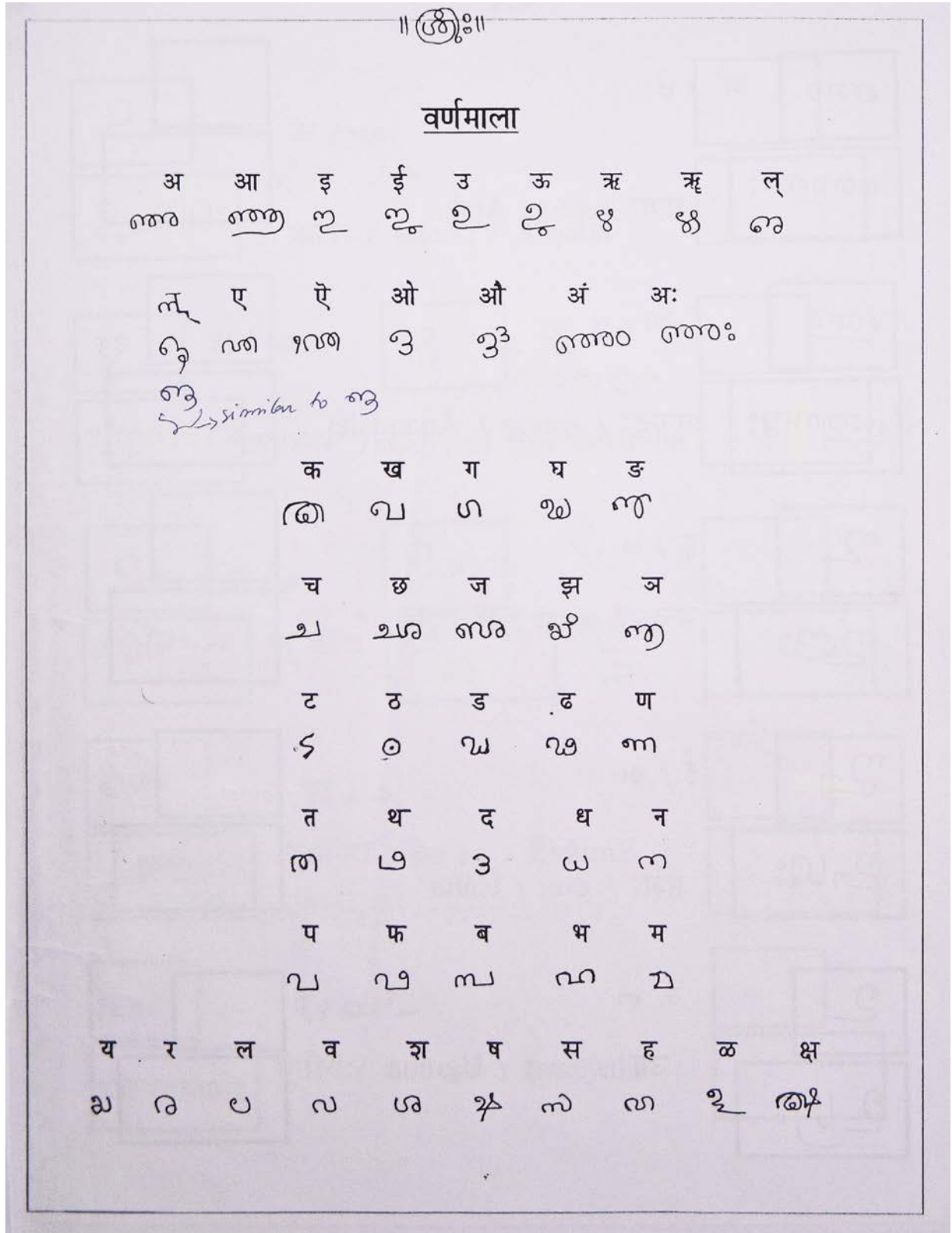
FIGURE 36.
Tulu-Tigalari script is being taught is several places in Bangalore and coastal Karnataka. The image above is a part of the teaching material used in one of these workshops conducted in Bangalore by *Shrii* Krishnaraja Bhat. His workshops are aimed at teaching this script primarily for Sanskrit language.
SOURCE
The Poornaprajna Samshodhana Mandiram, Bangalore.

FIGURE 37.
Tulu-Tigalari vowel sign and ligatures. Belongs to the workshop hand-out set seen in the previous page.
SOURCE
The Poornaprajna Samshodhana Mandiram, Bangalore.

VOWEL SIGN U -

Consonant			
ku			—
gu			—
chu			—
ju			—
ṭu		—	
ṇu			
tu			—
nu		—	
bhu			—
ru			
śu			—
hu			—

VOWEL SIGN UU-

Consonant		
kū		—
gū		—
chū		—
jū		—
ṭū		
ṇū		
tū		—
nū		
bhū		—
rū		
śū		—
hū		—

FIGURE 38.

Tulu-Tigalari vowel sign 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:			
	ಌ	ụ	
	ಌ೯	ụụ	
	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	ṛ	
	ಋ	ṛṛ	
	ಎ್	ε	a of man
	ಎ್೯	εε	a of mat
	ಎ	e	e of bet
	ಏ	ee	a of mate
	ಒ	o	o of obedience
	ಓ	oo	oa of coat
Dipthongs:			
	ಐ	ai/ ei	i of like
			ai of main
	ಆಯ್	ayụ/ ay	
	ಆಯಿ	ayi	
	ವಯಿ	eyi	
	ಔ	au/ ou	ov of love
			ov of stove
	ಅವ್	avụ/ av	
	ಅವು	avu	
	ಒವು	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)

ಪೀಠಕ

	ತ	ta
	ದ	da
	ಪ	pa	p of copy
	ಬ	ba	b of big

Stops aspirated:

ಖ	kha
ಘ	gha
ಛ	cha
ಝ	jha
ಠ	ṭha
ಢ	ḍha
ಥ	tha
ಧ	dha
ಫ	pha
ಭ	bha

Alveolar stop:

ಸ್ಟ್	sṭ	treated as a cluster of s and ṭ

Nasals :

ಙ	ṅa	ng of sing
ಞ	na	n of bench
ಣ	ṇa
ನ	na	n of name
ಮ	ma	m of man
○	m	ṅ before k,kh,g,gh
		n 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

Semi-vowels trills, laterals and fricatives:

ಯ	ya	y of yard
ರ	ra	r of tree
ಲ	la	l of light
ವ	va	v of very
ಶ	śa	sh of sheep
ಷ	ṣa
ಸ	sa	s of see
ಹ	ha	h of head
ಳ	ḷa
ೞ	ḻa
ಃ	ḥ

Also note

◌	stands for ṳ after consonants
◌	stands for є after consonants

Avagraha

S	stands for deleted vowel in texts

FIGURE 39.
(Previous page & Above) Tulu Orthography in Kannada Script as listed in the Tulu Lexicon. Tuḷu has a few additional vowels which are frequently used as discussed earlier: short un-rounded 'ṳ' (A + *Virama*), long un-rounded 'ṳṳ' (AA + *Virama*) and short 'Є' (E + *Virama*), long 'ЄЄ' (EE + *Virama*). These additional phonemes referred to in the above image are already being used in Kannada script for Tuḷu 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:

<u>Vowels</u> :

	Front	Central	Back
High	i ii	u�ṳ u̩u̩	u uu
Mid	e ee		o oo
Low	ɛ ɛɛ		a aa

<u>Consonants</u> :

Stops and affricates :

voiceless	:	p	t	ṭ	c	k
aspirated	:	ph	th	ṭh	ch	kh
voiced	:	b	d	ḍ	j	g
aspirated	:	bh	dh	ḍh	jh	gh

<u>Sonorants:</u>

nasal	:	m	n	ṇ	ñ	ṅ
oral	:	v	l	ḷ	y	
trill	:	r				
sibilant	:	s	ṣ	ś		
fricative	:			h		

The following phonemes have marginal status:

<u>Consonants:</u>

ph	th	ṭh	ch	kh
bh	dh	ḍh	jh	gh
		ṣ	ś	

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.

22   **A COMPARATIVE STUDY OF TULU DIALECTS**   Chapter - I

Table - 1 (Contd.)

Distribution of Phonemes

Vowels	Initial	Medial	Final
ụ	+	+	+
ụụ	-	+	+
a	+	+	+
aa	+	+	+
u	+	+	+
uu	+	+	+
o	+	+	+
oo	+	+	+

Illustrations :

Vowels	Initial		Medial		Final	
i	irε	leaf	kidε	cow-pen	aḍi	bottom
ii	iinụ	You (hon.sg)	niirụ	water	pii	human excreta
e	edε	chest	cembu	copper	aaye	he
ee	eeḍụ	goat	keeḍụ	harm	kaḍee	to grind
ε	--	--	--	--	tarε	head
εε	--	--	ḍεεnsụ	dance	baalεε	O! my dear child
ụ	ụnda	Lo! take	naḍụgụ	to tremble	kaaḍụ	forest
ụụ	--	--	poomụụḍe (Nb)	he told: it has gone	tindụnụụ	it has eaten
a	aṅgi	shirt	karε	side	kara	earthen pot
aa	aanε	elephant	naalụ	four	tinpaa	to cause to eat
u	umi	husk	kuḍu	horsegram	sappu	leaf
uu	uunụ	native, village	nuulu	thread	skruu	screw
oo	oñji	one	koḍε	umbrella	tooʈo	garden
oo	ooṇi	lane	kooḍi	corner	suupoo (Sb)	to show

FIGURE 41.

Analysis and examples of Tulu special vowels ɘ & ɘː in Tulu language.

SOURCE

Kekunnaya, Padmanabha. "Chapter 1." A Comparative Study of Tulu Dialects. Udupi, Karnataka: Rashtrakavi Govinda Pai Research Centre, 1994. 22. Print.
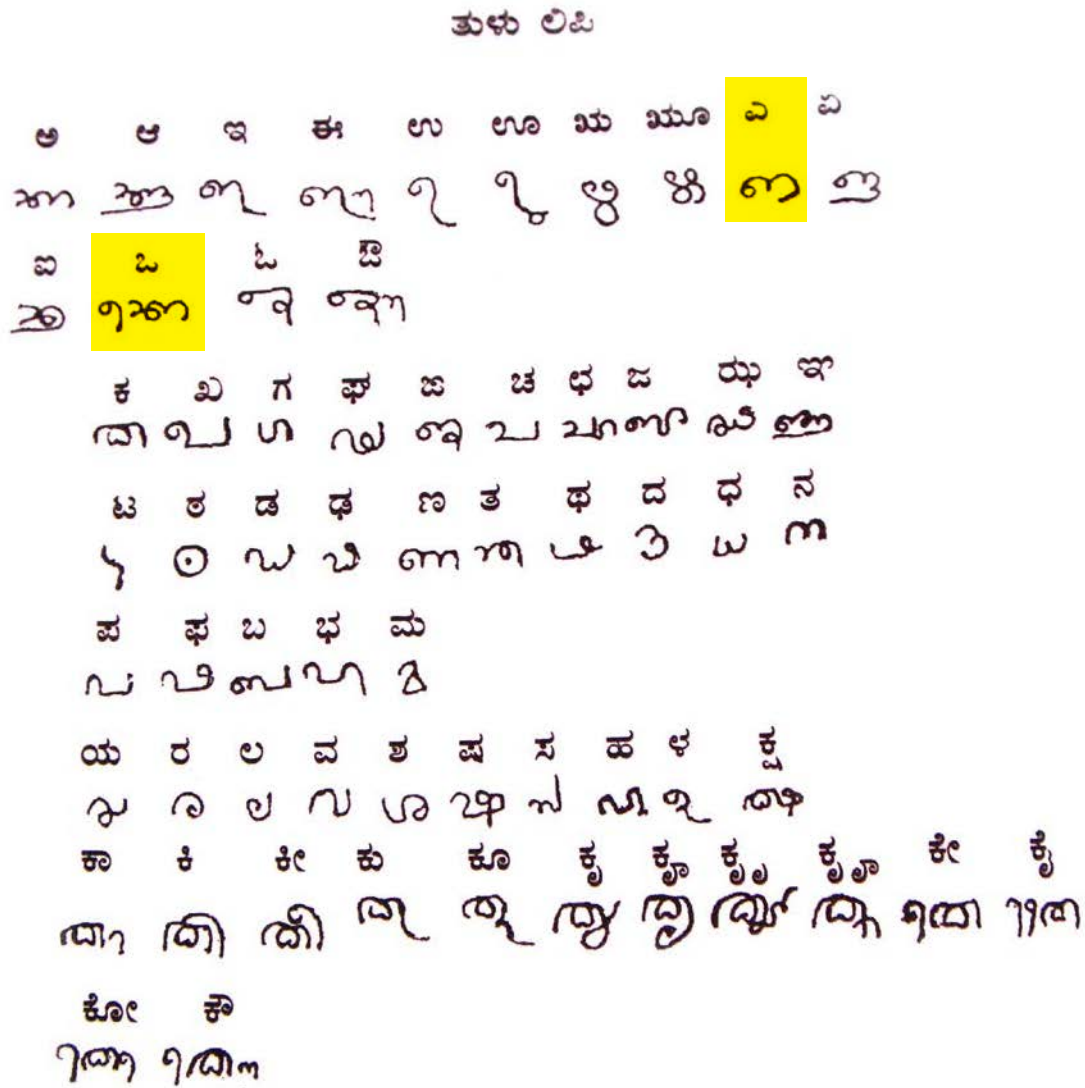
FIGURE 42.

Additional Tulu-Tigalari vowels E and O as proposed by Dr Devarakonda Reddy. The need for these two characters have been clearly stated here. However, the character shapes experimented with in the above image disrupt the traditional Tulu-Tigalari character representation. Vowels EE & AI assume new forms. Vowel O is replaced by AI character shape.

SOURCE

Hasthaprathi Adhyayana, Samavesha Sanghatana, Volume 1, Page 60, 2012.

This image credits (source) for this is given to Dr. Devarakonda Reddy below this publication.
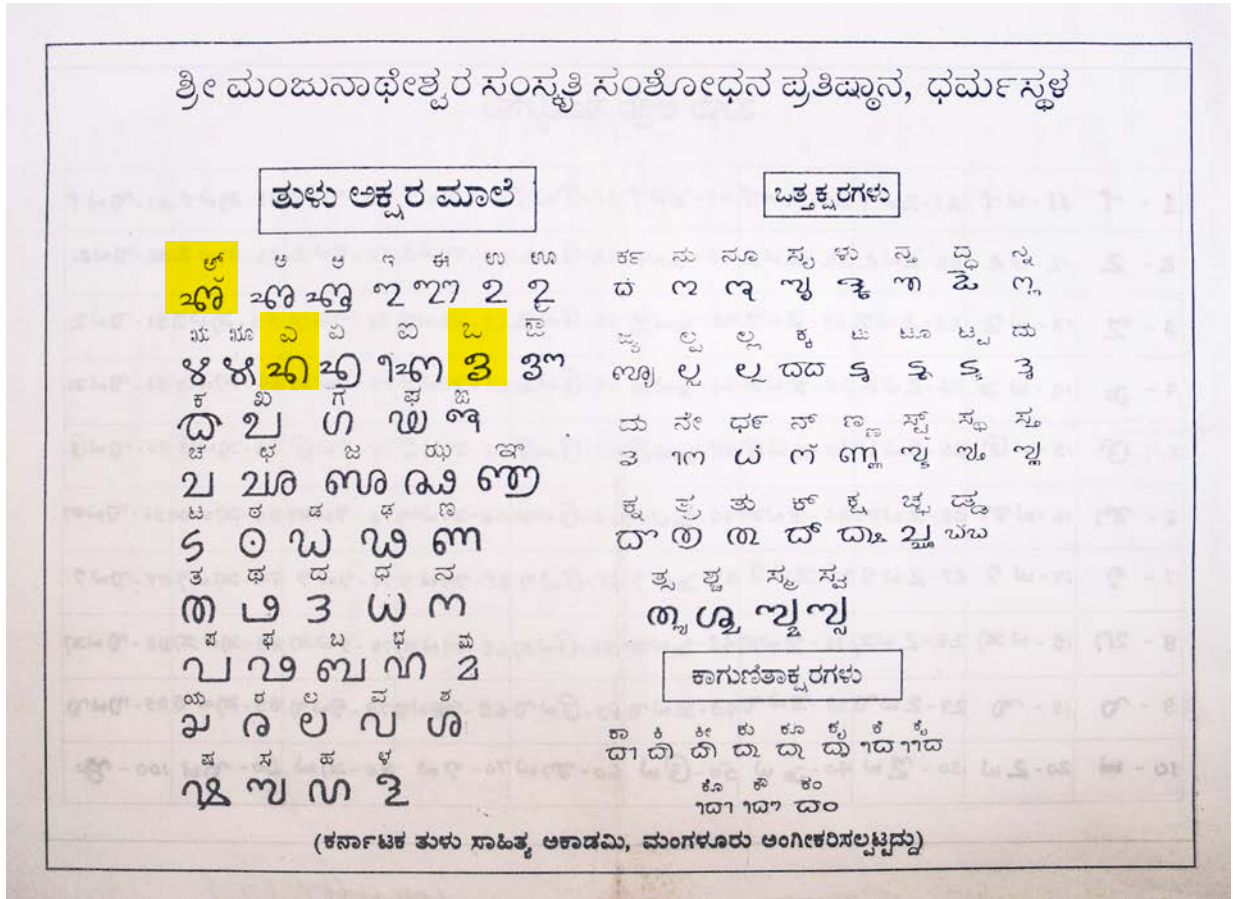
FIGURE 43.
Leaflet distributed by Dharmasthala Samshodana Pratishtana, Dharmasthala to encourage the adoption of Tulu-Tigalari script for Tulu language. Here we see the recently added vowel E as proposed by S R Vighnaraj. Also the Tigalari long vowel OO is interpreted as short vowel O. This is a mistake that might have arisen from the author's familiarity with the Malayalam script. A + *Virama* combination is also included.

SOURCE
Dr S R Vighnaraj, Dharmasthala Samshodana Pratishtana, Dharmasthala.

FIGURE 44.1.

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.

SOURCE

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

Parishkrutha Tulu Lipi
By Dr. Radhakrishna Belluru
Kasaragod, 2009

S. A. Krishniah
Udupi

FIGURE 44.2.

E & O

SOURCE

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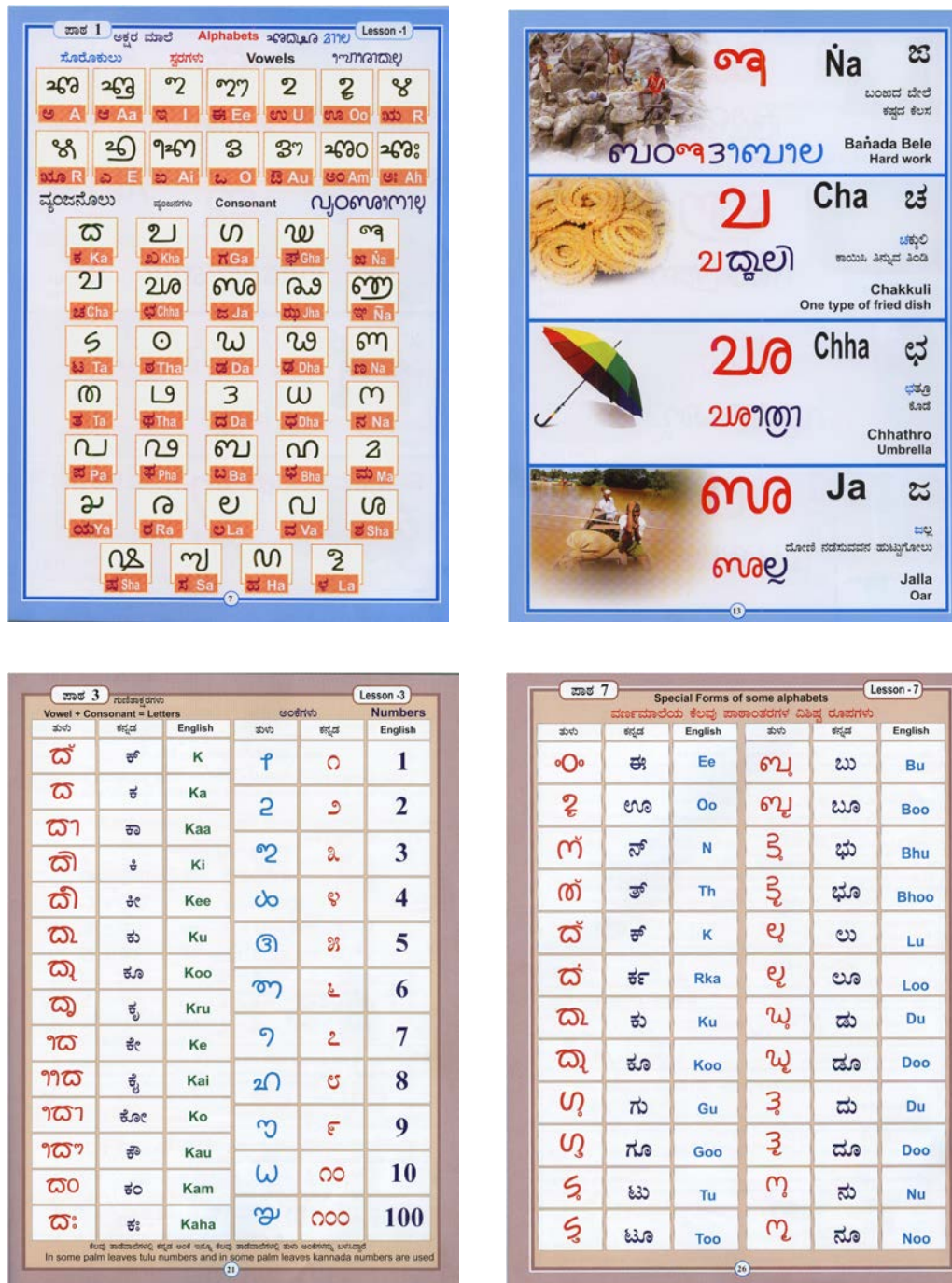Tulu Lipi. Mangalore, Karnataka Tulu Sahitya Academy. Print.

FIGURE 45.
Tulu-Tigalari (Tulu lipi) primer 'Tulu Aksharamaale' published by Karnataka Tulu Sahithya Academy (Pg. 7, 13, 21, 26); Mangalore. The characters and orthography seen here is once again roughly based on Puninchattaya's work published as a book called 'Tulu Lipi'. The glyph shapes appear to be the similar to Figure 44 and carries forward the same errors.

SOURCE
http://www.tuluacademy.org/en/category/tulu-alphabets/

ಪಾಠ ೧

ತುಳು	ಕನ್ನಡ	ತುಳು	ಕನ್ನಡ
	ಌ್		ಮ
	ಅ		ಏ
	ಆ		ಐ
	ಐ		ಒ
	ಈ		ಜೆ
	ಲು		ಅಂ
	ಲೂ		ಅಃ

ತುಳು ಲಿಪಿ / 7

ಪಾಠ ೨

ತುಳು	ಕನ್ನಡ	ತುಳು	ಕನ್ನಡ
	ಕ		ಜ
	ಖ		ಝ
	ಗ		ಞ
	ಘ		ಟ
	ಙ		ಠ
	ಚ		ಡ
	ಛ		ಢ

ತುಳು ಲಿಪಿ / 9

ಪಾಠ ೩

ತುಳು	ಕನ್ನಡ	ತುಳು	ಕನ್ನಡ
	ಣ		ಫ
	ತ		ಬ
	ದ-ಥ		ಭ
	ಧ-ದ		ಭ
	ಧ-ನ		ಮ
	ಪ		

ತುಳು ಲಿಪಿ / 11

ತುಳು	ಕನ್ನಡ	ತುಳು	ಕನ್ನಡ
	ಯ		ಷ
	ರ		ಸ
	ಲ		ಹ
	ವ		ಳ
	ಶ		ಱ

FIGURE 46.

(Previous Page & Current Page)

The first ever book published solely to teach Tigaglari script by Venkataraja Puninchathaya on which several later Tulu-Tigalari characters were based. This book also popularied the term 'Tulu Script' for Tulu-Tigalari

SOURCE

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

ಲಂ ಕ್ನೊ ನ್ಡ ಲಂ ಗ ನುಂ ಸ ತ ಲ ದ್ಭ ಮ ಣ್ಡ ಲ ಮ ನುಂ ತ

HAṂ NNO NDU LM GA NUṂ SA KA LA BHUU MA NNDDA LA MA MUṂ KA

FIGURE 47.
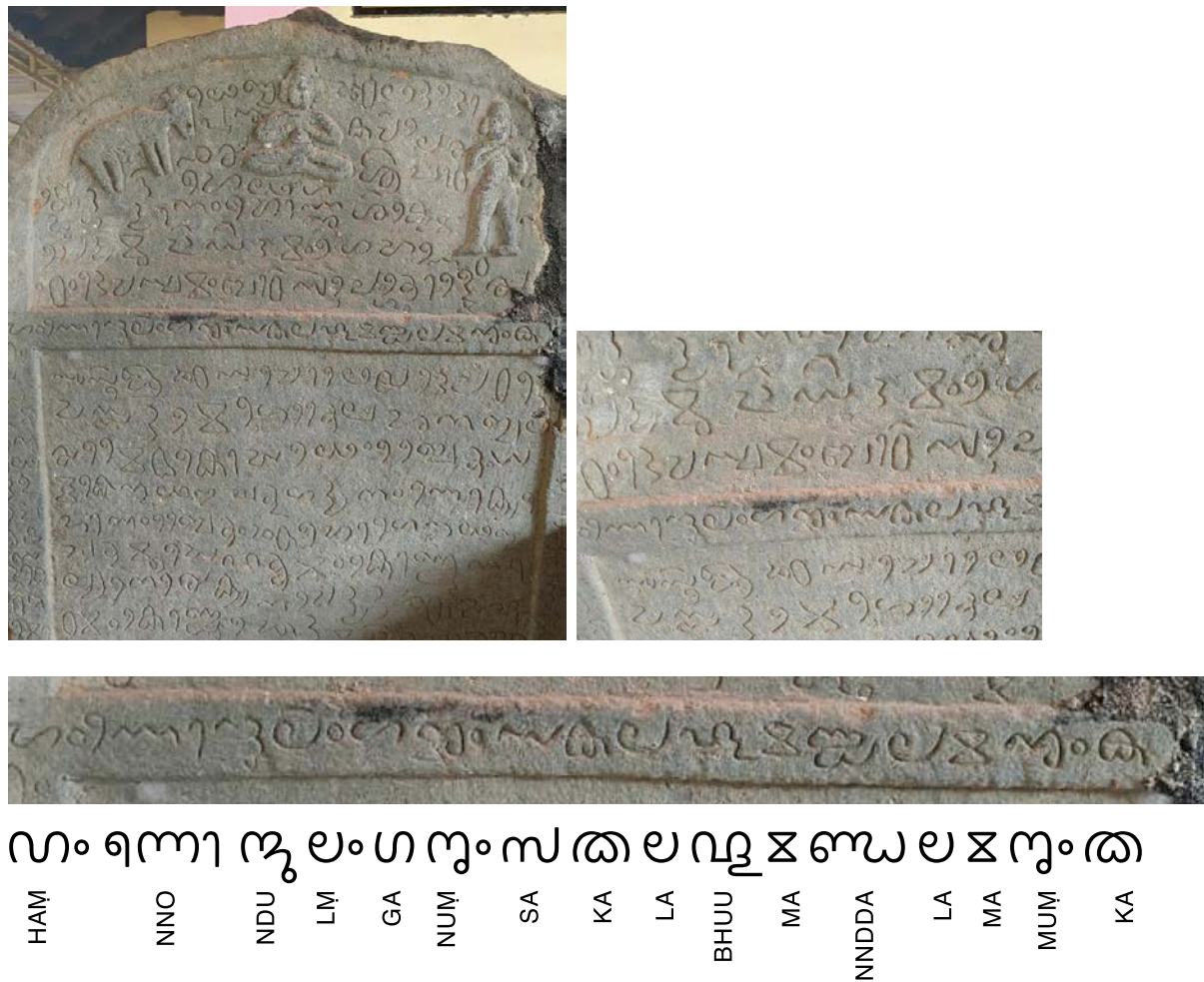A recent disocvery of what appears to be an old Kannada + Sanskrit language stone inscription by
Malathi Bhat in the Tulu-Tigalari script.
Location : Vishnu temple, Kitre Village, Bhatkal Taluk, Uttara Kannada district
SOURCE
Malathi Bhat

FIGURE 48.
A stone inscription found in Yellapura, Uttara Kannada District in the Tulu-Tigalari script. Dated circa 13th-14thC
SOURCE
Keladi Venkatesh Jois

Appendix :

A few sample glyphs for examining the vowel variants :

Rare forms = Pink // Refer Sup. Paper : ' A list of common Tulu-Tigalari conjuncts' for details.

VOWEL II			(all forms left are rare)
VOWEL UU			
VOWEL EE			(confusable : NA+TA)
VOWEL AI			
VOWEL OO			
VOWEL AU			

ISO/IEC JTC 1/SC 2/WG 2
PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS
FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646[1]
Please fill all the sections A, B and C below.
Please read Principles and Procedures Document (P & P) from http://std.dkuug.dk/JTC1/SC2/WG2/docs/principles.html **for guidelines and details before filling this form.**
Please ensure you are using the latest Form from http://std.dkuug.dk/JTC1/SC2/WG2/docs/summaryform.html **.**
See also http://std.dkuug.dk/JTC1/SC2/WG2/docs/roadmaps.html **for latest *Roadmaps*.**

A. Administrative

1. **Title:** *Updated proposal to encode Tulu-Tigalari script in Unicode*
2. Requester's name: *Vaishnavi Murthy Yerkadithaya , Vinodh Rajan*
3. Requester type (Member body/Liaison/Individual contribution): *Individual Contribution*
4. Submission date: *January 15, 2022*
5. Requester's reference (if applicable):
6. Choose one of the following:
   This is a complete proposal: *Yes it is a complete proposal*
   (or) More information will be provided later:

B. Technical – General

1. Choose one of the following:
   a. This proposal is for a new script (set of characters):
      Proposed name of script: *Tulu-Tigalari*
   b. The proposal is for addition of character(s) to an existing block:
      Name of the existing block:
2. Number of characters in proposal: *78*
3. Proposed category (select one from below - see section 2.2 of P&P document):
   A-Contemporary   B.1-Specialized (small collection)   B.2-Specialized (large collection)
   C-Major extinct   *Y*   D-Attested extinct   E-Minor extinct
   F-Archaic Hieroglyphic or Ideographic   G-Obscure or questionable usage symbols
4. Is a repertoire including character names provided?
   a. If YES, are the names in accordance with the "character naming guidelines"
      in Annex L of P&P document? *Yes*
   b. Are the character shapes attached in a legible form suitable for review? *Yes*
5. Fonts related:
   a. Who will provide the appropriate computerized font to the Project Editor of 10646 for publishing the standard?
      Vaishnavi Murthy (Author)
   b. Identify the party granting a license for use of the font by the editors (include address, e-mail, ftp-site, etc.):
      Vaishnavi Murthy (Author) -- vaishnavimurthy@gmail.com
6. References:
   a. Are references (to other character sets, dictionaries, descriptive texts etc.) provided? *Yes*
   b. Are published examples of use (such as samples from newspapers, magazines, or other sources) of proposed characters attached? *Yes*
7. Special encoding issues:
   Does the proposal address other aspects of character data processing (if applicable) such as input, presentation, sorting, searching, indexing, transliteration etc. (if yes please enclose information)? *Yes*
   Relevant information is provided in the proposal

8. Additional Information:

Submitters are invited to provide any additional information about Properties of the proposed Character(s) or Script that will assist in correct understanding of and correct linguistic processing of the proposed character(s) or script. Examples of such properties are: Casing information, Numeric information, Currency information, Display behaviour information such as line breaks, widths etc., Combining behaviour, Spacing behaviour, Directional behaviour, Default Collation behaviour, relevance in Mark Up contexts, Compatibility equivalence and other Unicode normalization related information. See the Unicode standard at http://www.unicode.org for such information on other scripts. Also see Unicode Character Database (http://www.unicode.org/reports/tr44/) and associated Unicode Technical Reports for information needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard.

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before? *Yes*

    If YES explain   *This proposal improves on several preliminary proposals to encode this script*

2. Has contact been made to members of the user community (for example: National Body,
    user groups of the script or characters, other experts, etc.)? *Yes*

        If YES, with whom?   *Several Manuscript Archives & Script Researchers across India*

        If YES, available relevant documents: *Yes, L2/17-422, L2/21-212*

3. Information on the user community for the proposed characters (for example:
    size, demographics, information technology use, or publishing use) is included? *Yes*

    Reference: *The user community is discussed under section 3 of the proposal*

4. The context of use for the proposed characters (type of use; common or rare)

    Reference: *Documenting manuscript materials*

5. Are the proposed characters in current use by the user community?

    If YES, where? Reference: *It is used to study the large body of manuscripts found in this script*

6. After giving due considerations to the principles in the P&P document must the proposed characters be entirely
    in the BMP? *No*

        If YES, is a rationale provided?

        If YES, reference:

7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)? *Yes*

8. Can any of the proposed characters be considered a presentation form of an existing
    character or character sequence? *No*

        If YES, is a rationale for its inclusion provided?

        If YES, reference:

9. Can any of the proposed characters be encoded using a composed character sequence of either
    existing characters or other proposed characters? *Yes*

        If YES, is a rationale for its inclusion provided? *Yes*

        If YES, reference: *Sections : 5.1 & 5.2*

10. Can any of the proposed character(s) be considered to be similar (in appearance or function)
    to, or could be confused with, an existing character? *No*

        If YES, is a rationale for its inclusion provided?

        If YES, reference:

11. Does the proposal include use of combining characters and/or use of composite sequences? *Yes*

    If YES, is a rationale for such use provided? *Yes*

        If YES, reference: *Refer Proposal*

    Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided? *Yes*

        If YES, reference: *Refer Proposal*

12. Does the proposal contain characters with any special properties such as
    control function or similar semantics? *No*

        If YES, describe in detail (include attachment if necessary)

13. Does the proposal contain any Ideographic compatibility characters? *No*

    If YES, are the equivalent corresponding unified ideographic characters identified?

        If YES, reference: