

## BEGINNING OF SCIENTIFIC OBSERVATIONS : FOUNDING OF LINGUISTIC SCIENCE IN INDIA

MALATI J. SHENDGE\*

*(Received 24 November 1995; after revision 29 September 1996)*

The Indians were the first people in the world to establish a method of observation on phonetic science and record their observations. Treating their everyday speech as a living, changing and evolving phenomenon, they established the manner of production of speech sounds, the play of the breath and speech organs, the classification of sounds based on the organs of speech, coined names for each class deriving them from the point of origin, etc. On the other hand they studied the usage of language spoken around them synchronically and diachronically deriving definite conclusions from their observations. They recorded all their findings. Their study of language was a pioneering activity which took place between 10th-6th c. BC and it is no wonder that Panini gave the first ever grammar of the world, to Sanskrit.

The author also applies the criteria of the science of philosophy to this material, which supports her contention.

**Key words :** Prātisākhya, Phonetics, Scientific observation.

### INTRODUCTION

Perhaps the seed for this paper was sown sometime between 1967 and 1970, when I attended seminars on a multiplicity of topics on history, sociology, economics, philosophy, social anthropology, political science organised at the Indian Institute of Advanced Study, Simla. During these seminars, very frequently the discussions led to the question : why was modern science not born in India? There was no single comprehensive answer to this question. Later my interests widened leading me to the *Rgveda* and to archaeology and their interpretations. I became acquainted with the development of the Indian Civilization from 2500 BC to about AD 1000, a span of 3500 years. Two or three years ago I came upon some linguistic material which gave me the necessary incentive to write the present paper as also to try to answer the question partially.

The question of scientific observation of a given phenomenon is at the basis of scientific thinking, the construction of theories and all that goes with it. So naturally the rise of science or rise of scientific thinking is closely related with it. This does not however mean that if it can be proved that one existed, the other will follow as a matter

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\*1603, Sadashiv Peth, Pune - 411 030.

of course. Even if this will be so, at least it could be said that the scientific observation is not an invention of the modern era or the last three/four centuries.

Long before that such observation formed the basis of accumulation of knowledge. Although this knowledge was acquired through the sensory perception, its objectivity and theory building capacity has been proved sound, which means it is comparable with modern scientific knowledge acquired through the intricate machines. In this context, the views of Karl Popper in *The Logic of Scientific Discovery* (London, 1968) on the methodology of creation of knowledge are worth noting.

"Before I can elaborate this view [i.e. the theory of the deductive method of testing] I must first make clear the distinction between the psychology of knowledge which deals with empirical facts, and the logic of knowledge which is concerned with logical relations." (p.30).

"In a similar way Einstein speaks of the 'search for those highly universal laws.....from which a picture of the world can be obtained by pure deduction'. There is no logical path, he says, 'leading to these....laws. They can only be reached by intuition, based upon the objects of experience'. (p.32).

The hypothesis put forth here is this : The Indians started observing and analysing the spoken language which was not different than the language of *Rgveda* and vedic literature, as a natural phenomenon<sup>1</sup>. The need for such observation was felt in the context of preservation and recitation of Vedic texts correctly. For doing this they studied and analysed the contemporary language, and made comparisons. These detailed linguistic observations are documented in works called the Śikṣās and the *Prātisākhya*s (i.e. works pertaining to the particular schools of *Rgveda*); the centuries during which these studies took place, though somewhat uncertain. However, Varma<sup>2</sup> has assigned a period 10-6th c. BC for this development. These observations were empirical, were arrived at through deductive method having a purpose behind them and fulfilling it. They considered the origin of speech as the interplay of human physical organs through which the breath passed while producing speech. They created terminology to describe the range of sounds of the language, they observed the causes of the linguistic change, and the ensuing results. They tested these results by studying and recording the variations in the pronunciation of the different schools of *Rgveda*, and established a general base and noted the differences. The Indian grammarians were pioneers in this respect and the description of the language they presented had no predecessor in the world as well as no rival till the 19th c. AD.

In the 18th c. Sir William Jones introduced the Indian system of phonetics to his countrymen<sup>3</sup>. There were many common points obviously due to his familiarity with the

Indian system between the Indian system and what William Holder had set forth in his *Elements of Speech*, which laid the foundations of western linguistic science<sup>3a</sup>. About the Indian influence on modern European phonetics, J.R.Firth, an eminent linguist has said, 'Without the Indian grammarians and phoneticians, it is difficult to imagine our nineteenth century school of phonetics'.<sup>4</sup>

#### A BRIEF RESUME OF HISTORY OF PHONETIC OBSERVATIONS

Pāṇini's (5-6 c. BC) 'Aṣṭdhyāyī' is the earliest Sanskrit grammar written in formulaic sentences in meta-language. The treatment and methodology is so scientific that it cannot be achieved in isolation. There might be a long grammatical tradition<sup>6</sup>. As many as 58 names of grammarians are mentioned in the various works as pre-Pāṇinian grammarians.

An analytical interest in the language is apparent in the two verses of *Rgveda*<sup>7</sup>, dedicated to speech. These refer to three stages in the development of language : (1) inarticulate speech, (2) primitive articulate speech, (3) language proper. The ancient Indians became interested in the phonetic description of the language at a very early date, the earliest indications being found in the *Aitareya Āraṇyaka*<sup>8</sup>, where effort has been made to compare the consonants and vowels and establish their distinguishing features. The importance of one and the other through comparisons with things, natural phenomena, or body parts of physical substances<sup>9</sup> has been emphasised. However, by 11-10 c. BC the phonetic thinking made an advance in theorizing on the concept of syllabication.

The definitions of syllabication were advanced: (1) *saṃhitā* was the interval between two syllables. This was suggestive of independent unity for the syllables occurring in juxtaposition. (2) *saṃhitā* was the interval by which the accent or the quantity of two syllables was distinguished. This definition shows awareness of accent or quantity as important ingredients in syllabication, (3) *saṃhitā* is a pronunciation of two syllables which are neither entirely separated nor united. The syllabic division is relative as the hearers of a given sample may perceive the breaks or continuity in syllables differently, though they may agree about prominent breaks in the chain of speech<sup>10</sup>

The *Aitareya-Āraṇyaka* does not have a term for phonetics. It becomes known to us in the *Taittirīya-upaniṣad*<sup>11</sup> as *sīkṣā* which was restricted to rudimentary instruction in pronunciation in individual sounds, accent, quantity and chanting of Vedic verses. The sense of the term is brought out by several commentators such as Visnumitra, Sayana and Madhusudana Sarasvati<sup>12</sup>. During the next stage the meaning attributed to the term *sīkṣā* becomes general phonetics and is found in *Vājasaneyi-prātiśākhya* where the sounds prescribed by the *sīkṣās*<sup>13</sup> are spoken of. In the second stage the *sīkṣās* were identified with the general principles of phonetics and applied to various Vedic texts. This application and its result came to be called the *Prātiśākhya*. Thus *Prātiśākhya*s dealt with applied

phonetics. No texts of Śikṣas of this stage are available presently. The *Rk-prātiśākhya* is earliest and *Yāska* quotes it<sup>13a</sup> which means it was in existence before 8th c. BC. The other *prātiśākhya*s are said to be *post-Pāṇinian* i.e. after 5th c. BC.

Even after the *Prātiśākhya*s came into existence, the observation of the general phonetic principles still went on. In fact they seem to have stimulated the interest further. So along with the rigorous details of the *Prātiśākhya*s a minute observation of the phonetic phenomena in the pronunciation of Sanskrit developed itself. All this was aimed at maintaining a strict accuracy in the pronunciation of Vedic texts. The minute details include the following observations : (a) sound health, calm temperament, freedom from nervousness, abstention from omission of sounds, (b) absence of overstresses, singsong and faltering tone; beginning and end of the speech to be consistently distinct; (c) abstention from habits of roughness, indistinct pronunciation, nasal twang, broken speech, and rigidity of the tongue, good teeth and lips. Thus these cover the condition of general health of the reciter, his speech habits and his physiology. As far as the linguistic details were concerned phenomena like the relation of the vowel and the consonant, the nature of accent, quantity, *svārabhakti* (vowel separation), the nature and quantity, of *anusvāra* and *raṅga*, development of observations on *abhinidhāna* (incomplete articulation), consonant-groups and doubling were observed and recorded. They were systematic and thorough in that they not only studied the language, but even speaker's psychological and physical conditions were taken into account. Recitation was not considered a mere vocal and oral exercise. The reciter's whole physical and mental personality was considered to be involved in producing an accurate sound.

Even if the *Śikṣās* and *Prātiśākhya*s are distinctly named, in scope they overlapped. The *śikṣās* were identical with *prātiśākhya*s as treatises on applied phonetics. This is the view taken by Varma, who says, 'It should be borne in mind that a hard and fast line between *Śikṣā* and *Prātiśākhya* was not possible. The authors of the *Prātiśākhya*s were themselves authorities on phonetics and their minute observations on syllabication, accentuation etc. are distinct contributions to general phonetics<sup>14</sup>.

Thus the phonetic approach to language which is the characteristic of modern descriptive linguistics originated in ancient India about the beginning of the 2nd millennium and end of first millennium BC (11-10th c. BC). All this linguistic activity took place in the context of the preservation of ancient vedic texts as accurately as possible. To facilitate the memorization of these texts certain mnemonic-recitative devices were invented which fixed the position of every word of the verses in different ways. They were known as *krama*, *ghana*, and *jaṭa-pāṭha*. They were preceded by a paraphrase of the Vedic texts which separated every word from the other. This along with the later three *pāṭhas* brought the number to four so that it was easy to check any word at any place whenever desired<sup>15</sup>. According to *Rk-prātiśākhya*, Babhravya (son of Babhru) *Bhagawān Pāñcāla* was the originator of the idea of *Kramapāṭha*<sup>16</sup>. It consists of repeating two words of the

*Samhitā* at a time. *Ghanapāṭha* consists of three words. It is not mere repetition but gradual adding up one word to another, then repeating the two, then addition of the third, then repetition of the three in the forward order. Then they are repeated in backward order and dropped one by one. The next *pāṭha* will start from the second word and so on.

This is how the phonetic studies i.e. the linguistic tradition in India began. Besides this there was the grammatical tradition distinct from the linguistic one. It was also scholarly and rigorous. *Pāṇini* belonged to this tradition. It was founded by Audavraji followed by *Śākaṭāyana*, *Gārgya*, *Yāska* and others. Burnell (1875) who acknowledged the superiority of *Pāṇini's* grammar, could not think that such a work can be a product of Indian genius. He says, 'There can be no question that *Pāṇini's* Grammar made an epoch in Indian literature, his name occurs everywhere, his treatise soon superseded all others.'<sup>17</sup> He adds, 'The circumstances under which this book (i.e. *Pāṇini's* grammar) was composed differed greatly from the older stage of Indian History; without some contact with foreign peoples and bitter disputes among religious sects at home, such highly developed enquiry into language as *Pāṇini's* treatise displays, is contrary to all experience.'<sup>18</sup> The conditions of foreign contact and domestic religious dispute are rather curious. It is unfortunate that he could not think of the long tradition of a secular study of grammar as a precondition for the production of such a fine specimen of specialised learning. *Pāṇini's* grammar is highly technical, clothed in an algebraic meta-language. It was obviously meant for those initiated into the grammatical tradition. According to Mahulkar<sup>19</sup>. 'The algebraic terminology and the theoretical vigour of his grammar were meant to systematize grammar itself as a deductive procedure in which groups of *sūtras* (i.e. short, petty, formulas) served as algorithms.' Modern opinion holds that the metalinguistic level of presentation was not of novelty to the *Prātiśākhya* phonetic tradition and it is possible that both the grammatical and phonetic traditions were a single stream<sup>20</sup>. *Pāṇini's* main focus was on words. He was not concerned with their articulatory details nor with the dynamics of speech in its natural form. He was concerned with them as morphemes. These two were the concerns of *śikṣā* and the *Prātiśākhya*s.

However, *Pāṇini* through his grammar has set up a model which the linguists have started realising only of late. The linguistic models can be of two types : one, in which language is described as a 'finished' activity, or it can be described as a 'developing' activity. In the former case a standardization of the linguistic usage of a speech community is involved. in the latter, the observation of a linguistic process going around is documented. The former is said to be a prescriptive model in which the grammar rules the living reality of language subsequent to its formulation. In the latter case, the developing model treats language as a phenomenon in continual flux and thus exposes its dynamics. The first is synchronic and the second diachronic.<sup>21</sup>

## THE PRĀTISĀKHYAS AND THEIR LINGUISTIC OBSERVATIONS

The other and perhaps the original name of this literature was the *Pāṛṣada*. *Ṛk-prātisākhya* is described by commentators as 'a *Pāṛṣada*'. The significance of the name speaks of an interesting origin or social aspect of this type of literature. It indicates that the class of treatise 'belonged to a social group (*pāṛṣad*) or groups in which the general principles of phonetics were adapted in Vedic texts, by oral instructions or public discussion'.<sup>22</sup>

The name *Prātisākhya* was later explained by Mādharma as a treatise belonging to each individual branch or school. However, Varma disputes this and suggests that since *Ṛk-prātisākhya* pertains both the *Śākāla* and the *Bāṣkala Śākhās*, the *Prātisākhya* may be interpreted to mean 'treatise on phonetics applied to a group of schools of a particular Veda'<sup>23</sup>. This view of Varma is based on *Vaidikābharāṇa*. Although each *Prātisākhya* writer studied the tradition of his school and framed rules, the observation and recording of articulatory facts was essential. The *Śikṣās* provided him the general rules of articulatory phonetics. But these were isolated speech sounds. He was required to study the transmutation of the isolated words to the rhythmic usage, from isophonic stage to combinational phonetics. This was due not only to the peculiarity of speech dynamics, but also to the speech habits, perhaps of greater importance. While doing this the *Prātisākhyas* observed the language and its mutations and recorded them. Thus they were not the works of individual writers but the whole scholarly community was involved in the creation of this new 'discipline', laying the foundations of world's first observations of a language as an empirical phenomenon. The specialists involved in this *pāṛṣada* were according to *Manusmṛti* were knowers of three vedas (*traividya*) logicians not opposed to *smṛti* and *śruti* (*hetukāḥ*), examiners of vedic texts logically (*tarki*), philologist, (*nairukto*), reciters of *dharmaśāstras* (*dharmapāṭhakaḥ*) and three *āśramas* viz. *gṛhastha*, *brahmacāri*, and *vānaprastha* etc.<sup>24</sup> The involvement of these disciplines gave the congregation of these scholars the name *pāṛṣada*, an interdisciplinary seminar reaching a consensus. This should also tell us of the ethos of that society and which produced such outstanding scholars and original thinkers and make their work a socially viable pursuit.

From the nature of the works it seems that the members of these groups were very well acquainted with the original texts of the Veda. They listed the sounds and the mechanisms producing them through a general consensus. This was the method of creating a new science. In order to remember easily these lists they are given a particular format. They are verified. First, words i.e. the morphemes or endings etc. are given, whereas the subsequent lines cite their occurrences in the texts.

This manner of listing the words is not very different from that of the *Nighaṇṭu*<sup>25</sup>, although in detail they differ from each other. The *Nighaṇṭu* that has come down to us consists only of lists of words, whereas Yāska's *Nirukta* comments on these words by

citing their occurrences in the Vedic literature, the *Prāṭisākhya*s do not give all these details but comment on the changes that take place during the actual usage of the words. *Yāska*<sup>26</sup> quotes *Ṛk-Prāṭisākhya* at least once.

The basis for *Prāṭisākhya* was śikṣā (phonetical studies) and grammar. A commentator of *Ṛk-Prāṭisākhya* called Uvaṭa points out that 'Sounds of the alphabet are taught in the world, (but) the *Ṛk-prāṭisākhya* selects only those sounds of this alphabet which pertain to its own *sākhya*<sup>27</sup>. That the sounds of the language studied in the *Śikṣās* were based on the experiences of every day life (secular) language as well as those of the Vedas becomes obvious from what is said in *Vaidikābharāṇa*, a commentary on *Taittirīya-Prāṭisākhya*. The sounds enumerated in the *Śikṣās* are common to secular and Vedic pronunciation; thus some *Śikṣās* mention sixty-eight sounds and others sixty-four sounds, the *Prāṭisākhya*s specify the sounds peculiar to their Vedic texts<sup>28</sup>. Uvaṭa, the commentator tries to limit the scope of these two types. *Śikṣā*, according to him, prescribes rules for pronunciation common to all the *sākhās* but do not specify in which *sākhās* a particular sound was used. This specification is the chief function of the *Prāṭisākhya*s. Thus the *Prāṭisākhya*s presupposed the phonetic description of Vedic sounds as given in the *Śikṣās*. Their function was specification and adaptation of sounds, prescribed by the *Śikṣās*. The tradition as embodied by Uvaṭa and *Vaidikābharāṇa* relates them to grammar in that it is the grammatical form of words which constituted the basis for the phonetic observations of the *Ṛk-prāṭisākhya*<sup>29</sup>. The *Prāṭisākhya*s have been correctly recognised to be based on a very advanced stage of grammar by Benfey<sup>30</sup>. Also the *Atharva-Prāṭisākhya*<sup>31</sup> clearly outlines the object of these as to describe 'the characteristic features of the four parts of speech viz. the noun, the verb, the prefix, and the particle - in the *pada*-and the *samhitā-pāṭha*. This only confirms the well known fact that the *Prāṭisākhya*s take the *pada-pāṭha* (the paraphrase) as their basis. They begin with words in their strictly grammatical form, which makes their basis partly grammatical. They were not completely based on the *śikṣās*, as their predecessors. In trying to devise the rules about the phonetic changes during *sandhi*, or in the synthetic form of language or during the actual, natural use of language, they were in a way observing the grammar of the language. They were not exactly correlating speech and spelling, but they were observing speech, comparing it with language and then formulating rules for the peculiarities or special features of Vedic language.

Thus *Prāṭisākhya*s had a distinct function when compared to *Śikṣās*. However, both these types of works together established a tradition of recording the phonetic and grammatical aspects, with the emphasis on the former aspect of the living language with a view to maintain the accuracy of vedic recitation. As seen above the *Prāṭisākhya*s had the *pada-pāṭha* (a vedic text of poems analysed into words) for their basis. They did not make the analysis as some scholars seem to think.<sup>32</sup> Also there is a trend to think this *Śikṣā-Prāṭisākhya* tradition to be popular, and that of *Pāṇini*, founded by Audavraji etc. to be a rigorous grammatical one, which is not correct. There is nothing popular about

them. They observed the living language and described the phenomena as accurately as possible. In this process, they coined terminology, defined the rules correctly, found illustrations for them from the Vedic texts (which identifies the spoken and literary languages). It is wrong to call all this activity popular. This is primarily the phonetic description of the language and then it is scientific description. It treats spoken language on par with a natural phenomenon and describes it in terms of sound and its nuances. Sound is the basic stuff of language. It should not be forgotten that they had no model of linguistic observations before them and that they were pioneers breaking new path.

There is no doubt that the *Pāṇinian* algebraic grammatical descriptions were extremely difficult for the uninitiate. But alongside with Audavraji's tradition of rigorous grammar writing existed another tradition which seems to have been older consisted of listing words of similar nature. There is evidence to think that in the earliest times listing was used as a method or mode of preservation of material<sup>33</sup>. This is found in historical works also. It is possible that the *Prātiśākhya*s, though of later origin and composed with a special purpose in mind, inherited the same methodology, added to it the more developed techniques of observing the language and the more recent needs of instruction and recitation in particular schools of Vedas. However, even the *Prātiśākhya*s mention the earliest grammarians like *Śākaṭāyana*, Gārgya and others respectfully in the texts. This shows that originally the two trends in language learning and preservation descended from the same source. Another reason for the bifurcation of this tradition seems to be the great change that came over the language between *R̥gveda saṃhitā* and the later language. The later language was observed and recorded by *Pāṇini*. From *Pāṇini* onwards this rigorous grammar compilation became a specialist's job. The earliest tradition also flourished and became embodied in the Aindra school<sup>34</sup>. The Katantra school established by Sarvavarman (C.1. AD) tries to unify both these into a single tradition. It was meant to be short and not to be clad in technical language. The name Katantra itself meant a short treatise or a handbook. According to its commentary '*Vyākhyānaprakriyā*' it was designed for the use of poets, not so intelligent(!) and those belonging to other sciences, lazy, sickly, and merchants handling the corn etc. and such other from other walks of life!<sup>35</sup> Sarvavarman's phonemic arrangement is taken from *Prātiśākhya*s and this clearly means that he traced his ancestry to this tradition rather than to other. To date the regional languages follow this very arrangement and to introduce the children to writing through this only.

The contribution of the *Prātiśākhya*s to linguistics<sup>36</sup> has been assessed by modern Indian and foreign linguists. The main functions of these works were the recording of the rules for the analysis and of the vedic texts<sup>37</sup>. This activity, chiefly of analysing the text, into the articulatory phonetical aspect of speech sounds was explained by the *Śikṣā*s (this being the province of general linguistics), whereas those variations, that came up while proceeding from the isolated words of *padapāṭha* to their combined form arranged in a



rhythmical, poetic manner in the *Samhitā* were explained in terms of combinatory phonetics. For this they had no model before them as they had the *Śikṣās* at the earliest stage and therefore they were treading on a totally virgin ground. In short they were the pioneers, "This was the empirical basis in the reality of articulatory facts and dynamics of speech was the solid foundation of all their linguistic observation".<sup>38</sup>

Filippo Sassetti (1540-1588), an Italian who lived in Goa for five years, was the first to report on Sanskrit language to the Europeans and to observe the resemblances between Sanskrit and Italian words. He was also the first to report the Indian discovery that different speech sounds can be systematically studied in terms of the movements of tongue and lips. The European scholars were impressed by the two articulatory principles which the Indians had discovered. So this means the Europeans learnt of these two principles defined by the Indians as *sthāna* (place of articulation) and *prayatna* (manner of articulation). The credit for the formulation of this classification is traced back to Saunaka<sup>39</sup> (identical with the Vedic *ṛsi*?). This discovery made in the 10th century BC or so was the foundation on which the *Śikṣās* and *Prātisākhya* works were based. These principles enjoyed the acceptance in the popular tradition of language teaching throughout India.

Even more important than this discovery was the formulation of concept of syllable which led them from sound (phones), the outer array of speech, to the basic core of sound (phoneme), which they defined and called it *aksara*, the immutable sound (that which stands alone). Thus they discovered not only what is known to modern linguistics as phonetics (the science of sounds) but also phonology (the science of Phonemes). Having formulated the concept of syllable, it was considered to be the basic unit of language first, the division of speech sounds into vowels and consonants only coming next. The syllable consists of a consonant and a vowel. Of these two which was the more important has also been decided by the *Prātisākhyas*. According to them the essential element of the syllable was the vowel. However, the Sanskrit terms *svara* (vowel) and *vyañjana* (consonant) do not exactly correspond to the 'vowel' and 'consonant' of modern phonetics. The Indian terms may have denoted 'a syllabic sound' and 'a non-syllabic sound' respectively. For the essential difference between *svara* and *vyanjana* lay in their relative independence<sup>40</sup>. This is far more scientific than the modern connotation. Despite this, in special cases they have conceded that a consonant could also form an independent syllable<sup>41</sup>. *Svara*, according to them, was "a syllabic sound' and not necessarily a voiced sound accompanied by a free passage of air through the mouth, and not producing audible friction, which the modern term 'vowel' signifies"<sup>42</sup>. This syllabic-unit is adapted by the ancient Indians as the basic unit in their writing system. In fact all the writing systems from ancient times, and especially those based on the Phoenician etc. have this syllabic unit as their basis. Only to the ancient Indians goes the credit of having used it in a highly systematised and scientific form leading to the accurate representation

of the sounds of a language with the facility of an almost effortless pronunciation of it<sup>43</sup>. Thus this present system of devanāgarī has to be traced back to the linguistic genius of the *Prātiśākhya* writers. The present author has demolished the hypothesis of the Roman letters being more suitable for writing than the Indian system<sup>44</sup>. In fact, the name alphabet and the sense attributed to it are misnomers. The so called Roman 'alphabet' is an unsystematised syllabary and conceptionally the alphabet representing one-sound on-sign is non-existent in the present writing systems of the world.

This (i.e. the concept of syllable) has deeper implications for the view of speech taken by the *Prātiśākhya*s. To them the speech sounds were measured, organized in syllables, rather than the speech sounds being units with determined limits following each other sequentially. This had effect on their analysis of the speech and also in the correct and precise representation of speech in writing. Both these are scientifically and inseparably tied together.<sup>45</sup>

Having determined the basic principle of syllabic division to be vocalic, the *Prātiśākhya* writers examined the rules of syllabic division. In this respect, the first rule they observed was that whether a consonant is initial or intervocalic, it will always go with the following vowel<sup>46</sup>. This was followed by rules for syllabication of final consonants. In this case the consonant will follow the preceding vowel. This observation was very sound, for it took into consideration the special nature of Sanskrit final consonants which are 'implosives'. This is considered to be of great importance in the history of Indian philology by Siddhesvara Varma<sup>47</sup>. Later in Prākṛit and Pāli, these implosive final consonants disappeared. Further rules on the syllabication of consonant groups syllabication of doubled consonants, syllabication of 'r't doubled plosive and so on in all nine varieties were also laid down. This practically analysed all possible combinations of consonants.<sup>48</sup>

The syllabic division was essential to determine syllabic quantity, quantity being itself and element of that division. The general principle at the basis of syllabic quantity was the duration. The *Prātiśākhya*s observed that 'a long vowel is a long syllable, but the syllable becomes longer if it is followed by a consonant'<sup>49</sup>. Varma observes : "This was a sound observation, free from the error of the Greek grammarians who supposed that a short vowel by nature becomes long by position before a consonant group. They ignored the fact that it was the syllable, not the vowel, that was lengthened".<sup>50</sup>

The Indians even went further and set up a measure for duration of a syllable, called *mora*. The short syllable was said to have one *mora* and the long one, two *moras*<sup>51</sup>. The ultimate basis of syllabic quantity was recognised to be phonetic duration even by rigid authorities<sup>52</sup>. They laid down clear cut rules for syllabic quantities<sup>53</sup>. The interest of modern linguistics in syllable as a phonological unit is only of recent origin. The problems faced by modern linguists in their work on syllable as a phonological unit were faced and solved by the *Prātiśākhya* linguists as long ago as 26 centuries (or perhaps more). The

major obstacle in their way has been the 'indeterminacy of syllable boundaries'. In order to determine this it is necessary that principles of syllabication, especially of the medial consonant clusters be known clearly<sup>54</sup>. As has been seen already syllable was the subject of study for the *Śikṣas* and the *Prātisākhya*s from the earliest times.

As a matter of fact, the failure to determine syllable boundaries in the case of English, and to capture important properties of strong and weak clusters of consonants which according to some western linguists 'point to a defect in our [i.e. western] theory that merit further attention'.<sup>55</sup>

This only testifies how correctly the importance of syllable was grasped by those earliest linguists of the world (*viz.* the *Prātisākhya*s) and how correct was the course of analysis they chalked out and the observations they made of the language spoken around them.

This brings us to a linguistic phenomenon, called by the *Prātisākhya*s, as *abhinidhāna*, the incomplete articulation<sup>56</sup>. It is also called *asthapita*, stoppage, and *bhaksya*<sup>57</sup> or *bhukta*<sup>58</sup>. Varma points out : 'This phenomenon has an important bearing on the Indian theory of the syllable and the history of consonants in the living dialects.'<sup>58a</sup> This phenomenon is noticeable even today in the regional language or in New Indo-Aryan and the modern users are unable to understand it which has led to ample corruption of pronunciation. The earliest description of this phenomenon has been given in the *Prātisākhya*s and is said to consist in the repressing of obscuring of a stop or a semi-vowel (except 'r') before another stop or a pause. The sound displaying this phenomenon is said to be pressed (*piditaḥ*), quite weakened (*sannataḥ*), and lacking in breath and voice (*hina svasanadaḥ*)<sup>59</sup>. *Abhinidhāna* literally means adjacent imposition. The *Prātisākhya*s lay down the conditions or the environment as modern linguistics would call it where *abhinidhāna* obtained. They are as follows : when a stop is followed by another stop, as in *arvagdevaḥ* where *g* before *d* was said to be obscurely pronounced or *d* before *bh* in *marudbhiḥ*. As said above this tendency has been there in Sanskrit from the earliest times, and continued in the Prakṛits.

There was no unanimity on this point, as different teachers like Vyādi Sākala, and others differed from each other, This indicates that they did not follow each other blindly but each teacher thought for himself and came to his conclusions through a demonstrable critical reasoning, which is the method, even in modern times of enhancing knowledge on a given subject.

This phenomenon (i.e. *abhinidhāna*) is described in terms of modern linguistics as follows : The *Prātisākhya* writers knew that the internal structure of a voiceless plosive in its normal articulation involves a dependency relation between two elements : a stop-element and a release element. In modern phonetics these two elements are designated as 'implosion' and 'explosion' respectively e.g. p = ><. When such a voiceless plosive

came finally in a word it had only the implosion, as in words like *sat* (truth), *ap* (water) etc. This articulatory phenomenon of holding-up or non-release of airflow was called *abhinidhāna* by the *Prātisākhya* writers<sup>60</sup>

Verma thinks that the *abhinidhāna* may have been 'a presumable provincialism of the incomplete articulation of finals'. But others would attribute it to an inherited 'gesture of articulation fighting a losing battle against the newer forces of weakening spreading all over the language'. This may be related to historical development<sup>61</sup>.

Yet another linguistic phenomenon observed by the *Prātisākhya*s is of retroflexion of certain sounds. These sounds are unique to Sanskrit as a member of the Indo-European family. So the western linguists assumed that these phonemes have been acquired by the Aryas in their contact with the Dravidian speaking population which presumably may have at one time lived in northern India. This phenomenon of retroflexion has puzzled the linguists and it has been difficult to fix its origin in time and space, and present a cogent argument to that end.

The efforts of the *Prātisākhya*s to record the manifestation of speech and making statements about them are stray as well as close-knit formulas. They were studying emerging linguistic phenomenon. 'What appeared to them to be changing and shifting were habits of speech which could be defined and described by referring to some articulatory features but at times they could not distinguish whether a habit was a dying one or a newly emerging one....'<sup>62</sup> The observations contain many types of linguistic phenomena pertaining to what modern linguists call 'the performance models'<sup>63</sup>. Some of those details which were not used by later grammarians can be useful for the microhistory of Sanskrit<sup>64</sup>.

The phenomenon of retroflexion is designated as '*nati*' (arching or curving) by the *Prātisākhya* writers belongs to this microhistory. The sounds which induced this process were called *nami* (archers) and those which came under their influence called '*namya*' (the curved) or *nantas* (the curved). The sounds which were phonetically similar to *nantas* but escaped from being so, were called '*a-nantas*' (not curved). These retroflexed sounds in the repertory of Sanskrit are the *ta*-class, or *ta*, *tha*, *da*, *dha*, *na* and *sa* of the sibilants.

The linguistic hypothesis presented by the *Prātisākhya*s to describe the emergence of the retroflex sounds was that presence of any of the ten vowels viz. *r*, *r*, *i*, *i*, *u*, *u*, *e*, *ai*, *o*, *au* in a word leads to the cerebralization of the following dental consonants. They called these vowels as *naminah svarah* (arching vowels). The sound which precedes is called the *namayita* or *nanta varṇa* (the arching letter). The next consonant is called the *namya* (the arched one). They created this terminology unaided and unprompted by any earlier experience of their own or of other. Their observations on the previous vowels and consonants constitute the so-called environment of modern linguistics. According to

the *Prātisākhya* linguist observers dental sibilant was the first consonant to undergo cerebralization or perhaps historically it was earlier than this. The *Rk-Prātisākhya* enlists in detail the environments of *ss*<sup>65</sup>. To study this phenomenon is to study the functional divisions between the two subsystems of vowels in old Indo-Aryan system. Secondly, the remark of the *Rk-Prātisākhya* writer that the teachers Vyādi, Sākalya and Gārgya, feel that *sandhis* called *sa-tva* and *na-tva* are obtainable due to grammar (*Jakṣaṇa*) (unlike others which are natural) which shows that they had become aware of the standardizing function of grammar. All the cases could not be brought under a single rule and therefore they were divided under three heads. Those in which the sound-change can be observed, those which were exceptions and those which were probable innovations. The instructions of these teachers to those who were faced with doubts during the recitations were that when in doubt 'whether to say it with a *n* or without a *n*, let him say it with a *n*'. Similarly about *s*<sup>66</sup>. The reason given is : 'Of that *samhitā*, the letter *n* is the strength, the letter *s* the breath, the self'. This means perhaps during the heat of recitation and in order to lay stress on the letter *n* and *s* were found useful. This interpretation throws light on the origination of *n* and *s* which were perhaps born of the emphasis or stress in recitation. If this is so, it means even while the *Prātisākhyas* were trying to observe and record, and in the process preserve the accurate recitation, in reality change was creeping in imperceptibly.

Basically the sound-change the *Prātisākhyas* analysed and described was due to the functioning of some of the linguistic phenomena. These were the euphonic changes which took place in the language as a matter of rule especially in prosody and also in prose, compositions. These were classified under *prayatna* or effort by them, and may be described as change in articulatory posture. Modern linguists tried to understand the phenomenon of cerebralization from prosodic view point but have not been able to obtain a satisfactory solution. From the point of view of the *Prātisākhyas* it was a sort of concatenation of action and reaction that led to cerebralization of first of the ten vowels, then of *s* and later perhaps of dentals. Even amongst the ten vowels, the historical rise of *r* and *ṛ* which did not exist in the earlier stage of the language need to be further examined. But to the *Prātisākhyas*, this stage was not available for observation and recording<sup>67</sup>. It seems to me that cerebralization set in during the force of recitation and some schools of *Rgveda* adopted it, but still it was a slow process. It means that in the original composition of *Rgveda*, the retroflexion was not part of the language. It seems that it is more due to the force during recitation than the prosodial necessity. Only gradually it became naturalized.

Thus the explanation of this linguistic phenomenon, according to the *Prātisākhyas*, was a change in speech habit. Modern linguistics tried to account for it as an external influence on Sanskrit, the language of the Aryans and could not convince itself.

Besides these the *Rk-Prātisākhyas* treated topics like euphonic combinations (*sandhis*)

of vowels and consonants, rules for doubling of consonants, length of vowels (in the syllables and limbs), rules for the *kramapāṭha* and the motives behind them and metres. They have not forgotten to add a chapter on how to impart training in the recitation (chap. XV). The *Taittirīya-prāṭisākhya*<sup>68</sup> is written in *sūtra*-style. It begins with the collection of letters (*varṇa-samāmnāya*) offers a complete analysis of all the sounds of sanskrit including the accents, production of phones and classification. It also defines clearly when dental *n* becomes retroflex *ṇ*, and dental *s* becomes retroflex *ṣ* and also all the other retroflex sounds *t*, *th*, *d*, the euphonic combinations, the rules for the loss of various sounds, records differing views, the duplication of letters, the pronunciation of *om* (*praṇava*) and differing views of *ācāryas* like Saityāyana, Kauṇḍinya, Plākṣi, Plākṣayana, Vālmiki. Under the name of *vācas sthānāni*, the seven *saptakas* of Indian classical music are given.

#### PRATISAKHYAS AS THE FIRST DOCUMENTED EVIDENCE FOR THE BIRTH

The ancient Indians laid the foundations of linguistics through their keen and systematic observation of the language spoken around them and the Vedic language. The rise of a linguist of the stature of Panini who even today is unrivalled is founded in this ancient tradition and systematised thinking.

As a matter of fact the keen, methodical, accurate, rigorous knowledge of and thinking in every walk of life by the early Indians is reflected in the remains of the protohistoric Indus civilization. There the archaeological findings stand witness to the precocious maturity, industry, execution, social and political organization, and other concomitant achievements of a highly developed urban civilization. The outstanding contribution has been made in architecture with all its concomitant requirements like use of baked and sundried bricks, stone, soil, use of lime mortar, conception, design and accurate execution of different types of structures ordinary and monumental, use of structures like granary with a system of controlling the dew or a bath with water-proofing and channelling, a drainage system and so on. Even in contemporary world these skills were precocious. The Indus Valley people also knew the use of wheel, both for vehicular traffic and as a device for pot-making, baking of pottery, familiarity with the use of cotton, wool and hemp, use of metals and precious stones, gold, silver, copper, bronze, lapis lazuli etc. trade international and domestic, knowledge of mining, extraction of metals from ores, metallurgy, and making of utensils, weapons, ornaments out of them which implies knowledge of smithing etc., agriculture, use of plough (which has been found in the Harappan context recently in Pakistan<sup>69</sup>), sickle, hoe and other instruments, and the processes, use of irrigation and dams<sup>70</sup>; the use of wheat and rice, domestication of horse<sup>71</sup>, cattle, dog, knowledge of navigation, shipping, knowledge of seal-making, developed concepts of political and strict administrative control<sup>72</sup>, uniformly exercised over the whole of the empire, extending from the Himalayan foothills to Baluchistan and from Oxus to Maharashtra, knowledge of writing numbers from one to thirteen, accurate

weights and measures, and knowledge of warfare, making of arms and so on. Accurate and precise systematic way of thinking was thus an ancient habit of the Indians. Since the civilization was so well developed in social, political technological and intellectual achievements it may also have had many scientific achievements to its credit which for want of documentation and its considerable antiquity cannot be reconstructed and studied. Their existence can only be surmised from the archaeological remains. A civilization as highly developed as the Indus civilization cannot be created without a developed state of science (in the relative sense), a strict physical, social and mental discipline, and a scientific bent of mind.

The composition of *Rgvedic* poems may have taken place between 2000-1850 BC<sup>73</sup> and some may be much earlier. The *Atharvaveda* and *Yajurveda* could also contain much older material, i.e. prior to 2000 BC although linguistically they appear to be much younger than *Rgveda*<sup>74</sup>. Some *Upaniṣads* could also belong to this age. It is obvious that the present recensions of these works are much later than the present recension or *Rgveda*.

After the Vedic literature, the *Prātisākhya*s provide us with the necessary documentation for the first ever description of a language. Because they dealt with the recitation of the Vedas, they have been preserved in tact. Therefore the *Prātisākhya*s as the first documents as evidence for the scientific genius of the Indians are unique. They stand at the beginning of a long series of this class of literature and its accompanying developments in the history of science and scientific thought in India. As pointed out earlier, the western linguistics has come into existence in the 19th century. after contact and knowledge of Indian linguistics as transmitted by Jones, Holder and others. Only in 1946, the sound spectrograph was developed in the west<sup>75</sup> which records a graph of the speech continuum and reveals details of the facts of language. After realising all the details made by these machines, Firth, the famous linguist, wrote: 'Phonetics and phonology have their ultimate roots in India. Very little of ancient Hindu theory has been adequately stated in European languages [to which may be added 'and also studied']. When it is, we shall know how much was lost....'<sup>76</sup> That the Indians who discovered, right at the beginning of their linguistic observations, the fundamental role of syllable and prosody in the language were proved right through the experimental phonetics, is the tangible result of the discovery of sound spectrograph. The experimental phonetics buried the phoneme which was threatening to be the fundamental notion (albeit wrongly) in linguistics. Thus the Indians have been proved to be correct even by modern development.

#### THE METHODOLOGY OF THE PRATISAKHYA

The method used by the Indians or it would be better to say that the method established as a matter of course was of deduction which is the method used in the observation of natural phenomenon by modern science. They treated language as a natural phenomenon and observed it, though only through sense perceptions. They discussed the individual

impressions, experiences, and utterance of sounds and then recorded these in versified form so that they can be easily recited, memorised and preserved. The original idea of the observation and classification of the language sounds, is as old as *Taittirīya-saṃhitā*<sup>77</sup> and *Taittirīya-aranyaka*<sup>78</sup>, where the repository of letters (*varna-samamnaya*) is discussed for the first time. Therefore it is possible to say that phonetics was born in the *Taittirīya-śākhā* of the *Rgveda*. The *Taittirīyas* were the first to analyse the sounds of Sanskrit and formulate them into a repertoire. After that the *Śikṣās* specialised in the linguistic analysis and classification of sounds. The *Prātisākhya*s devoted themselves to the special phonetic nuances of the various vedic schools.

The methodology of *Prātisākhya* was directly deduced from the actual observations of the language. It treated language as a natural phenomenon and observed it only through sense perceptions. It also discussed the individual impressions, experiences, and utterance of sounds and then recorded these in versified form so that they can be easily recited, memorised and preserved. Probably it is through observation of movement of the speech organs during the production of sounds that they drew certain conclusions. It is likely that several scholars and/or reciters of *Rgveda*, formed groups, made observations and noted their conclusions. This is the implication of their alternative name *viz. Pāṣada*. They set up general rules about the phonetic changes which occurred during the *saṃhitāpāṭha* and supported them by multiple examples scattered all over the Vedic literature. This was also the test of their objective observations of living language applied to the prosodic compositions. While doing this they coined the necessary terminology describing the phenomena observed, e.g. the terms *nati*, *nanta abhinidhāna* which are already discussed above. They also distinguished major and minor rules, and exceptions to the rules<sup>79</sup>. The term used for general rules is *nyāya*; *apavāda* are minor rules. They also laid down essential qualifications for one who would be able to learn this science. They were : one, the learner should have good knowledge of the words, their sequence, and their divisions. Secondly, he should be in possession of complete knowledge of the *svaras* (accent), their length and measures. The origin of this science is said to be in the discussion on the priority of mind (*mānas*) or speech (*vak*) i.e. on the problem of the exact sequence between speech and mind. The view that the speech came first and mind, later, was held by *Survira* and his pupils whereas others thought differently. According to them mind came first and later, speech, The distinct (lit. pure) pronunciation of letters or that pronunciation without any euphonic combinations is said to be the study of words<sup>80</sup>. This essentially means that even though the enquiry began with the metaphysical question, they did not merely speculate about the nature of speech, nature of mind (as consciousness) and the matter ends there. Instead they tried to analyse speech in its concrete form in the empirical reality. The first observation is of the relation between breath and speech. The breath is the *ṣa-kāra* (i.e. the letter *ṣa*), whereas the strength lies in *ṇa-kāra* (i.e. the letter *ṇa*). Therefore breath is called *ṣa-kāra*, it is the soul. With *ṇa-kāra*, the vedic *saṃhitā* recital is said to be powerful. It is because (in the utterance of a sound) the breath and the speech pour into each other. The breath is offered into



speech and the speech is poured (or offered) into the breath. As it is said, 'whenever one recites or speaks during speech, that becomes breath. Speech licks away the breath. If one observes silence, or sleeps with the breath (drawn in), then it becomes speech. At that time breath has licked the speech'<sup>81</sup>. This formed the basis of their observations. It also falsifies the oft-repeated accusation *viz.* the Indian proneness and fondness for fancy and irrationality. Besides this it also means that even if the question posed belonged to metaphysical level, it is possible to search for its reply in empirical reality and in a rational manner. In the *Prātisākhya*s it can be easily perceived that in the context of religion, quest of scientific thinking, objective and rational methodology and manner of thinking developed. The scientific requirements of accuracy, precision, objectivity etc. found here are not surpassed even by modern scientific achievements. And therefore the whole tradition of phonetics and phonology which we see here in the developmental stage consummated ultimately into *Paṇini's Aṣṭadhyāyī*. Further the single work of *Paṇini* itself created a new branch of grammatical study.

#### CONCLUDING REMARKS

There may be an objection that the phonetic observations of the early Indians were not tested objectively and therefore they cannot be treated as 'scientific'. First, as has been pointed out above the objective testing in the sound spectrograph has confirmed through experimental phonetics the Indian discoveries of the fundamental role of syllable and prosody in the language. The experimental phonetics restored phones to their rightful place by correcting the role of the concept of phoneme. Secondly, from developments in India, it may be observed that the study of phonetics started with the empirical experience of mind and speech. They wanted to know whether mind came first or speech came first. This was the working hypothesis for investigation. The Indians could have easily found the answers on the basis of their knowledge of yogic and religious experiences limiting themselves to the empirical, they investigated the mechanism of sound production. The physiological aspect of sound was taken up. How are the speech sounds produced? What bodily organs were involved in their production? They may have also experimented with the speech organs, and their functions, and the function of breath. All these are not only very original observations but the fact that perhaps they were made for the first time in human history adds to their originality and purposeful directed thinking made with a view to discover the facts. There is no record of such observations made anywhere else in the world. Man was looking at himself objectively as something distinct from animals, and was treating his mode and capacity of communication through sound as reflected in language as a system of sounds, sound as he understood it being the basic stuff of language. In fact just like the invention of writing which was made in the 4th-3rd millennium BC and which has affected man intellectually extensively, similarly this idea of studying language in this manner should be treated as a landmark in the human intellectual evolution. With this man became aware not only of himself but that the idea that language as a system of sounds and meanings can be studied and analysed was itself

a kind of intellectual revolution and the beginning of the scientific thinking which is reflected in the later serious works as distinct from religious or philosophical literature. It was unique in its formulation and execution as an unprecedented, original, pioneering and systematic endeavour.

The Indians used the data collected through the sensory apparatus for this study, analysis and formulation of the theory. The 'sensory apparatus' has a recognised status as a basic means or instrument of observation in modern philosophy of science. The sensory apparatus and the language we learn as children (i.e. the first language) are supposed to be the two instruments with which we can start our discovery of the regularities in our environment. 'Not only do we have nowhere else to start from, but the regularities indicated there are not pure figments of imagination. They have stood the test of time and generalizing on their basis has at least not prevented the survival of generations. Given that our environment does not radically change, we have good reason to accept them as starting point.'<sup>82</sup> Therefore the phonetics founded by the Indians in the 10-8 century BC cannot be dismissed as unscientific. In fact the importance of the ancient Indian linguistic observations is far more fundamental than so far realised. It is actually the beginning of scientific observation which was discovered elsewhere in the world only in the last four centuries or so. It is not that modern descriptive linguistics could not have come into existence without the earlier studies conducted by the Indians, but still in reality as said above it owes a great deal to the Indian approach, and in facts. The fundamental notion of historical linguistics viz. the relation between the present forms being derivable from earlier forms of words was already known to etymologists like Yāska in 8th century BC. Surprisingly enough the linguistic theories of the Indians have not only stood the test of time but have not been disproved by modern theories. Thus as far as scientific thinking was concerned the Indians were the pioneers.

The search whether mind came first or speech came first was an unbiased pursuit. They chalked out a special course of the analysis of language and its sounds. This speaks for their openminded, unprejudiced search for objective truth. Had they accepted their every day experience and generalised on its basis perhaps metaphysical speculation would have been the result. The initial stages of this controversy which led to this question are even more significant. It was about the pause or gap or junction after the utterance of one sound and the following one. For example *agnim ile* (= *agnimile*). Having uttered *agnim*, but before the utterance of *ile*, there is an imperceptible break or pause.

The question they asked was what happens to the mental processes, to the utterance and to the breath. The final reply was mind continued to think, then the sound was uttered and for this breath was the instrument. Theirs was a 'think tank' in the form of four thinkers who put forth different views. Mandukeya held that the first syllable was earth and the second was heaven. Their union (*samhitā*, joining or putting together) is the air (*vāyu*). Maksavya supported the view that the union or euphonic combination is the

space (*ākāśa*). Agastya was of the view that both are alike and independent. There is no difference between *vāyu* and *ākāśa*. This discussion pertained to the position between the utterance of two syllables. Whether it was breath or it was just empty pause. This was the material aspect, whereas the psychic (*ādhyātmi*) state which is what is the question aimed at. In this respect Suravira Mandukeya held that the first half is speech and the latter one is mind, whereas breath is in between. However, his oldest pupil said that the former half is mind and the latter half is speech. With mind one first resolves and then utters speech. Therefore, he said, mind is the first half, speech the second one and breath is their union. This is the three horsed chariot compact of mind speech and breath<sup>83</sup>. They have considered many other subtleties like the correct accentuation etc. With this they began analysing every day speech sounds and also the changes that took place in prosodic compositions.

The three criteria set up by Karl Popper in his '*The logic of scientific discovery*'<sup>84</sup> are found in these. This system set up by the Indians belonged to the world of man (as opposed to natural), i.e. his speech system, it was not metaphysical, and it represented our experience. Needless to add that this method is the deductive method.

If the 20th century has discovered the multi-disciplinary approach, as cited already Manusmṛti had described in detail the composition of the *pariśadas* (sitting around) or roundtables on which were represented disciplines like logic, philosophy, vedic studies, philology, recitation of Dharmaśāstras, etc. ten in all. About 3000 years ago man's genius was equally, if not more, modern and scientific, which proves the dictum that every bygone age was once modern in its own right. To what extent they were modern and succeeded in their inventions and discoveries we know from the fact that they have not been surpassed. Will our modern civilization be able to achieve the same standard and success?

#### REFERENCES AND NOTES

1. For those who do not know : There is difference between the language of *Rgveda* and what is known as classical Sanskrit. The *Rgvedic* language is the oldest form of the language which came to be known later as Sanskrit. It is believed that the *Rgvedic* language underwent evolutionary changes and after Pāṇini's grammar, *Aṣṭadhyāyī* (the eight chaptered one) the language assumed a static form which is so till today.
2. Varma fixes the date of *Prātisākhya*s around 500-150 BC. However, this depends on the date of Yaska who is quoted in *Rk-prātisākhya* the oldest of them. Presently Yaska is considered to have lived a little earlier i.e. 8-6 c. B.C. So the *Rk-prātisākhya* may have been composed about that time. However, the kernel of the Indian phonetic literature should be earlier by about three centuries i.e. 1000 BC. The stage of *Aitareya-Āraṇyaka* which betrays a very advanced stage of phonetic study may be about 1000 BC. Between the *Aitareya-Āraṇyaka* and *Prātisākhya*s are said to be *Śikṣā*s, considered to be the prototype of the *Prātisākhya*s and which were also very probably synchronous with the period of the *Aitareya-*

- āraṇyaka*. Yaska refers to them as the *Pārsadas* (the outcome of learned gatherings). Varma, S. *Critical studies in the phonetic observations of Indian grammarians*, London : The Royal Asiatic Society, 1929, p. 20-21.
3. Firth, J.R. *The English school of phonetics*, Transactions of Philological Society, 1946, pp 92-136, esply 116-118
  - 3a. *Ibid*, pp 115-116
  4. *Ibid*, p. 119
  5. Bohtlingk, K.O. (ed), *Pāṇini's Grammatik*, 2nd ed, Leipzig 1887 (reprint, 1964)
- Vasu, S.C.. *The Aṣṭadyayi of Pāṇini*, Benaras, 1891-97 (Reprint (1962))
6. Mahulkar, D.D. *Pre-Pāṇinian grammarians*, New Delhi : Northern Book Publishers, 1990, Appendix A, p.265.
  7. *Rgveda-saṃhitā*, ed S.D. Santavalekar, Aundh, 1940, X.71, 125.
  8. *Aitareya-Āraṇyakam*, ed. Babashastrī Phadake, Pune : Anandasrama series, No. 38, 1943, II 2.2.
  9. Varma, *Ibid*, p.3.
  10. *Ibid*, p.4.
  11. Limaye, V.P. and R.D. Vadekar, *Eighteen principal upaniṣads*, Pune : Vaidika Samshodhana Mandala, 1958, *Taittiriya-Upaniṣad* 1.2, p.
  12. Varma, *Ibid*, p.4.
  13. *Vājasaneyi-prāṭisākhya. 1.17 of Kātyāyana*, ed V.Venkatasarman, Madras : Madras University, 1934
  14. based on Varma, *Ibid*, pp.4-12, esply p.12.
  15. Even todate there are many brahmins who can recite the Vedic texts and can be called upon to recite particular verses in the manner of *krama-ghana* or *jaṭā-pāṭha*. That means they were used as human computers just to memorize the texts in a given sequence and reproduce or recall or recite whenever needed. This mnemonic discipline was the basis of the oral tradition and preserved the texts accurately until the 14th c. AD. Because of the use of these human computers or recorders it was not found

necessary to commit these texts to writing. Those who think that the Vedic texts were committed to writing for the *pāṭha* system are not correct. *Pāṭhas* preserved the pronunciation and text both, not so the written text.

16. *Rgoratisākhyā* XI, 33 :
17. Burnell, A.C., *Essay on Aindra School of grammarians*, Mangalore, 1875, p.38.
18. loc. cit. Emphasis added.
19. Mahulkar, D.D., *The Pratisakhya and Modern linguistics*, Baroda : M.S. University, 1981, p.44.
20. loc. cit.
21. Ibid, p.12-13.
22. Varma, Ibid, p.12
23. Ibid, p. 12-13.
24. *Manusmṛti*, ed V L. Panashikar, Bombay, 1933, XI.III
25. V.K. Rajawade. *Yāska's Nirukta*, Pune : VSM, 19, also contains the *Nighantu*.
26. Ibid, I.17.
27. Varma, Ibid, p.13
28. Kasturi Rangacharya & R.Shama Shastri (Eds), *Taittirīya Prātisākhya*, with the commentaries of Somayāya and Gargya Gopalayajvan, Mysore, 1906, p.5 comment on I.1.
29. Varma, Ibid, p.15.
30. As cited by Varma, loc.cit.
31. I.1.
32. Mahulkar, *The Pratisakhya*, etc., p.40.

33. Shendge, M.J. *The earliest population of India : Links between Rgveda and Maḥābhārata*. Annals Golden Jubilee Volume, Bhandarkar Oriental Research Institute (Pune), 1992 (In press).
34. Burnell, *Essay on the Aindra School of Grammarians* ; Balvalkar, S.K., *Systems of Sanskrit grammar*. Delhi : Bhartiya Vidya Prakashan, 1976, pp.9-10.
35. Belvalkar, Ibid, p.68.
36. Scharf, H. *A history of Indian literature : Grammatical*, Wiesbaden : O Harrossowitz, 1977, Chap V, pp 127-134; Varma, S. Ibid, pp.1-25.
37. Although some scholars would include in this synthesis (e.g. Mahulkar, *Prātisākhya*s tradition etc. p.44) it seems to me it is not correct. The *Prātisākhya*s only conducted the analysis or even that was given to them ready made in the *padapāṭha*. Whereas *samhitā* was there as a prosodic composition, which observed the rules of grammar of the natural language. Their main function was to provide clear phonetic and other descriptions. This was mainly analytical.
38. Mahulkar, Ibid, p.45.
39. Mahulkar attributes this to Shintre, S. *Rg-Prātisākhya*, p.3, but is untraceable. However Saunaka wrote the work called '*prakṛta prātisākhya*' according to Shintre, Ibid, p.6.
40. Varma, Ibid, p.57.
41. Ibid, p.58.
42. loc.cit.
43. Shendge, M.J., Asokan Brahmi-alphabet or syllabry? *Journal of Indian history*, 63, 1985, p.19-32.
44. Ibid.
45. Those who wish to adopt Roman script for the Indian languages will be taking a retrogressive step. The *Devanāgarī* is the most consistent and clearly thought out system, which the Roman script is not. Moreover the former has this historical background and is a product of Indian genius.
46. *Rg-prātisākhya*m 1.15; *Taittirīya-prātisākhya*m, XX1.2
47. Ibid, p.141.

48. based on Varma, pp.61-87.
49. *Rg-prāṭisākhya*, XVIII, 20.
50. Varma, Ibid, p.88.
51. Ibid, p.89.
52. Ibid, p.90.
53. Ibid, pp. 91-98
54. Mahulkar, *Prāṭisākhya Tradition*, p.54.
55. loc. cit.
56. *Rg-prāṭisākhya*, VI.5;
57. *Atharva-prāṭisākhya*, I.48.
58. *Caraniya-sīkṣā*, Chap. VII, Fol 8.
- 58a. Varma, Ibid, p.137.
59. *Atharva-prāṭisākhya*, I.43, as cited by Varma.
60. Mahulkar, Ibid, p.57.
61. Shendge, M.J., *The Language of the Harappans*, forthcoming.
62. Mahulkar, Ibid, p.109.
63. loc.cit.
64. Ibid, p.110.
65. *Rg-prāṭisākhya*, V.

66. *Aitareya-āranyaka*, III.2.6.
67. Shendge. *Ibid.*
68. See note 28.
69. Dani, A.H. *The Indus Civilization*
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76. J.R. Firth, *op.cit.*
77. p.3, vi. 4.7.3.
78. Vii.1
79. *Rg-prātisākhya*, I.23.
80. *Ibid.*, I.3.
81. *Aitareya-āranyaka* III, 1.6.14 cited by Uvata in his comment on *Rg-prātisākhya* I.4.
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83. *Aitareya-āranyaka*, III.1.1.
84. London : Hutchinson & Co., 1968 (revised edn.) p.37.