

# AN ESTIMATE OF THE VAIŚEŚIKA SŪTRA IN THE HISTORY OF SCIENCE

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Sixth century B.C. has been generally held as the period which heralded the dawn of what has now come to be known as Greek science. The Greek thinkers, one after another, displayed a rare intellectual activity to understand the world of matter and form in the three hundred years from the beginning of the sixth century to the close of the fourth century B.C. Bold speculations appeared then on the primordial stuff of the world, atomism, mathematical models and structure of the knowable universe. There were schools of thought which often ran parallel to one another and not a few of them tried to delineate their own positions in such a way as to refute and exclude the views of others. The Indian Vaiśeṣika system, on the other hand, had assumed a definite shape by the sixth century B.C. when even the pre-Socratic thinkers were gradually generating their views. A fact of great significance is that the Vaiśeṣika contains in it the most important ideas enunciated by some of the leading Greek thinkers including Aristotle. The paper discusses the origins as well as the probable date of the Vaiśeṣika system, presents a synopsis of the contents of the ten chapters of the *Vaiśeṣika Sūtra* and tries to discuss the merits as well as the internalized limitations of the Vaiśeṣika system in relation to the Greek science.

The Vaiśeṣika school, a powerful exponent of pluralistic realism and one of the six recognized Indian orthodox systems,<sup>1</sup> is supposed to have been propounded by a sage known as Kaṇāda. The word Vaiśeṣika has meanings more than one: According to a Chinese text quoted by H. Ui,<sup>2</sup> Vaiśeṣika means superior, excellent or distinguished in relation to the Sāṅkhya which is another orthodox system. Perhaps Vaiśeṣika also refers to one of its categories, viz. viśeṣa or particularity, which is a peculiar concept of this school alone. Just as the word Vaiśeṣika is sought to be interpreted in different ways, coincidentally enough, the propounder of this school, too, has different meanings. Kaṇāda, Kaṇabhuj, Kaṇabhakṣa, as the name of the propounder goes, means one who eats particle or grain, indicating probably the atoms or particles; and this is attributed to the fact that Kaṇāda enunciated the essentials of an atomic theory. There is also a view<sup>3</sup> that Kaṇāda was living on grains he would pick up on the roadside. Ulūka, yet another name of the author according to Buddhist writings, is construed to mean that his habits were similar to those of Ulūka or owl; for it was believed that he used to meditate in a dense forest in day-time and wander for food at night.<sup>4</sup> For this reason,

the Vaiśeṣika school is also known as *Aulūkyā* or *Aulūkyā-darśana* and the latter in fact is the title of the chapter on the Vaiśeṣika system in the *Sarva-Darśana Saṃgraha* of Mādhavācārya. Tradition also has it that the Vaiśeṣika system was revealed to Kaṇāda by a Divine being in the form of Owl.

The two principal authorities of the Vaiśeṣika school are: (i) *Vaiśeṣika Sūtram* by Kaṇāda and (ii) *Padārthadharmā Saṃgraha* (also known as *Praśastapāda Bhāṣya*) by Praśastapāda.<sup>5</sup> Though recognized as a gloss on the *Vaiśeṣika Sūtra*, the *Padārthadharmā Saṃgraha*, in its form and repertoire, has the characteristics of an original work. In addition, *Praśastapāda* seems to have been influenced discernibly by the Buddhist ideas and was perhaps a predecessor to or a contemporary of the reputed Buddhist preceptor, Vasubandhu (c. fourth century A.D.).<sup>6</sup> The present paper does not deal with *Praśastapāda Bhāṣya*, although it is an important authority of the Vaiśeṣika school; instead it sets out to examine the *Vaiśeṣika Sūtra* of Kaṇāda in the history of scientific ideas.

#### *Origins and probable period of the Vaiśeṣika Sūtra*

The Vaiśeṣika school even in its sūtra form is very old and, as will be indicated later, there are evidences to show that it is pre-Buddhistic. However, the origins of the sūtra are obscure and it is rather difficult to establish its primary layers of thought in a systematic way. There are reasons to believe that the Vaiśeṣika school was in its beginning heterodox in its position not taking shelter under the umbrella of the orthodox Vedic views. In the Vedic period, there were undoubtedly views<sup>7</sup> opposed to the teachings of the Vedas and, in the complex and symbolic Vedic literature, are also found references to views which are non-Vedic. That these views might have had considerable following is substantiated by the fact that not much time elapsed before they took definite shape and assumed the form of sūtra, thus facilitating their wide-spread communication. In the course of this transition, possibly as a result of various synthesizing influences at work then, the Vedic non-material concept *dharma* became intertwined with the dominant material ideas of the *Vaiśeṣika Sūtra*. In the process though the Vaiśeṣika lost its heterodox character and entered the orthodox fold, it continued to be a fountain source of ideas, both naturalistic and rational, over a long period of time. Even the Cārvāka, a singularly heterodox school, with its emphasis on direct perception as the only one means of valid knowledge, receded to the background. On the other hand, the Vaiśeṣika which recognized both perception and inference as means of acquiring knowledge found many adherents and promoters whose number steadily increased as the Vedic ideas on *dharma* also became associated with it.

At this stage it is desirable to emphasize that in so far as knowledge is concerned, the Vaiśeṣika does not accord a pride of place to the Veda or

*Śabda* (verbal testimony meaning tenets of the Vedas or of wise men) just as the Nyāya does, even though the opening *Vaiśeṣika Sūtras* speak of *dharma*. It is true the Vaiśeṣika holds the view that the *summum bonum* of all knowledge is freedom from misery and in this light discusses *dharma* in its ethical and ritualistic aspects. But the stress seems to be on the knowledge of the six categories leading to self-realization<sup>8</sup> and, from this point of view, it is rather difficult to subscribe to the opinions expressed by some scholars<sup>9</sup> that the Vaiśeṣika grew in the fold of the *Pūrva-mīmāṃsā*, an orthodox system which elaborates the concept of *dharma*. Though the first three sūtras of the Vaiśeṣika are on the lines of *Pūrva-mīmāṃsā* relating to *dharma*, they do not necessarily indicate that the Vaiśeṣika was an early school of *Pūrva-mīmāṃsā*. What is important in the main position of the school is the interpretation of the six real categories and more important still is the causal backing of that interpretation. It seems more probable that the Vaiśeṣika grew out of heterodox views even in the so-called Vedic period and gradually absorbed a few Vedic ideas, thus adjusting itself to 'orthodoxy, just as the later Vaiśeṣika adopted itself to Śaivism and imported Īśvara into the system.'<sup>10</sup>

The *Vaiśeṣika Sūtras* were known to the Buddhist Nāgārjuna, as could be seen in his work called *Mahāprajñāpāramitā-śāstra*. However, the *Vaiśeṣika Sūtras* themselves do not make any reference to the Buddhist doctrines. Besides it would seem that not only the Vaiśeṣika preceded Buddhism and Jainism but also made its contributions to the growth of these heterodox sects, as many of the ideas of the latter are closely allied to the Vaiśeṣika views.<sup>11</sup> The Vaiśeṣika school regards time as the ultimate cause and this is undoubtedly an ancient view. Further there is rather an undeveloped form of inference in the sūtras. It is reasonable to suppose, as Das Gupta suggests, that 'these sūtras are probably the oldest that we have and in all probability are pre-Buddhistic.'<sup>12</sup>

#### *Important layers of thought in the Vaiśeṣika Sūtra*

The *Vaiśeṣika Sūtram* has ten chapters<sup>13</sup> (*adhyāyas*). The total number of sūtras is 368 which, in an aphoristic style, give an insight into the different facets of the experienced world of matter. In the first chapter, the six categories, viz. substance (*dravya*), attribute (*guṇa*), action (*karman*), generality (*sāmānya*), particularity (*viśeṣa*) and inherence (*samavāya*), are enumerated. The substances are: earth (*prthvī*), water (*ap*), fire (*tejas*), air (*vāyu*), *ākāśa*, time (*kāla*), space (*diś*), self (*ātmanā*) and mind (*manas*). There are 17 attributes: colour (*rūpa*), taste (*rasa*), odour (*gandha*), touch (*sparśa*), number (*sankhyā*), dimension (*parimāṇa*), distinctness (*prthakatva*), conjunction (*saṃyoga*), disjunction (*vibhāga*), priority (*paratva*), posteriority (*aparatva*), intellect (*buddhi*), pleasure (*sukha*), pain (*duḥkha*), desire (*icchā*), aversion (*dveṣa*) and volition (*prayatna*). The five types of actions are: throwing upwards

(*utkṣepaṇa*), throwing downwards (*avakṣepaṇa*), contraction (*ākuncana*), expansion (*prasaraṇa*) and going (*gamana*). Substance is one which possesses actions and attributes, and is an inherent cause. Attribute has substance as its substratum, and action is the absolute cause of conjunction and disjunction. Generality and particularity are dependent upon intellection.

The second and third chapters deal succinctly with the nine-substances. It is stated that (i) earth has colour, taste, smell and touch; (ii) water possesses colour, taste, touch, liquidity and viscosity; (iii) fire has colour and touch; (iv) air has touch only. *Ākāśa* does not have any of these attributes. While earth, water and fire are perceptible, air and *ākāśa* are imperceptible and the two imperceptibles are arrived at by a process of inference. 'Even though air cannot be seen, its existence can be inferred by touch, just as the existence of the genus of cows may be inferred from the characteristics of horns, humps, tails, etc.' Touch does not belong to visible things and is the mark of the invisible air. The existence of air is thus sought to be inferred on the basis of certain known characteristics (*sāmānyatā dr̥ṣṭa*). *Ākāśa* is also established by inference as a substratum for sound, for it is pointed out that sound is not an attribute of the tangibles; nor does it belong to self or mind. The characteristic attribute of earth is odour, of fire, heat and of water, coldness.

The Vaiśeṣika holds that time is the cause of all produced things and that it does not exist in things eternal, but exists only in those non-eternal. It is time which gives rise to notions of posteriority, simultaneity, slowness, quickness, etc. Even so time is one. The mark of space is that from which the knowledge of remoteness and nearness is derived. Like time, space is also one, only in relation to the conjunctions of the sun, there are different notions like east, west and the like. Space as well as time is all-pervading and likewise is *ākāśa*. However, space, time and *ākāśa* are regarded as inactive. Sound, the attribute of *ākāśa*, is invisible, not eternal and produced by conjunction, disjunction and other sounds.

In the third chapter, there is a cogent reasoning to establish by inference the existence of self and mind. Self is a substance (non-material nevertheless) in which the knowledge gained by the contact of the senses and their object inheres. 'Inhalation, opening and closing of eyes, life, motion of mind, pleasure, pain, desire and aversion are the marks of the existence of self.' Of great importance is the view expressed here that revelation (or invoking the aid of scriptures) is not the only evidence of the existence of self. It is pointed out that there is no other substance to which the notion of 'I' could be applied than self. The notion of 'I' is established by its pronounced and sensorial attributes and this notion does not depend upon revelation. Though self is one, it is regarded as manifold because of certain situations or manifestations (like being rich or poor, happy or miserable,

learned or ignorant), and for this reason everyone has one self. Mind is also a substance necessary for the contact between the self, senses and objects. 'Existence and non-existence of knowledge on coming into contact with the objects of sense, are the marks of the existence of mind.' The conjunction of mind with these is necessary to produce cognition. Mind is also referred to as *antahkaraṇa* or internal organ in the ninth chapter.

In the fourth chapter it is stated that eternal is that which is existent and has no cause. The effect exists because of the existence of the cause. It is further stated that the common visibles are numbers, extension, separateness, conjunction and disjunction, priority and posteriority, as well as action inhering in a coloured substance. The senses give the knowledge of attributes as well as of existence. The gross substances, earth, water, fire and air, exist in three forms—body, sense-organ and objects. The body is neither composed of five elements nor of three elements, but a combination of atoms is not denied. Bodies are twofold: those born of the womb and those that are not so born.

In the fifth chapter, there is a well-thought-out and explicit view that falling results from gravity (*gurutva*) when there is no conjunction. Falling of water also results from gravity in the absence of conjunction, while flowing is the resultant of the attribute, fluidity. The sun's rays cause water to ascend through conjunction with air. Pealing of thunder is a mark of the waters in the sky and results from conjunction with water and disjunction from a cloud. Upward or sideward motion takes place without a particular impulse. There are, however, some movements or motions which are attributed to an inexplicable source—*adr̥ṣṭa* or the unseen. The movement of the gem (*mani*)—construed to mean a vessel of gold filled with water, which moves under magical incantations—is due to the unseen—*adr̥ṣṭa*. The movement of needle towards a magnet is also due to *adr̥ṣṭa*. Again, the circulation of water in the trees is caused by *adr̥ṣṭa*. Likewise, *adr̥ṣṭa* is the cause of the upward rising of flames, crosswise flow of the air and the first action (i.e. creative motion) of atoms. Even conjunction with food and water, eaten and drunk (i.e. assimilation of food), is caused by *adr̥ṣṭa*. Where there is no *adr̥ṣṭa*, there is no existence of conjunction of body with soul and without *adr̥ṣṭa* there is no emancipation. Fasting, continence, spiritual life, performance of sacrifice, giving of alms, offering oblations, religious observances conduce to *adr̥ṣṭa* as stated in the sixth chapter.

The seventh chapter deals with the specific attributes—colour, taste, smell and touch, and the great as well as the minute dimension. It is pointed out that extension is produced by the plurality of causes. Extension is eternal in the eternal ones like the atoms, i.e. it is not destroyed in them, while in the produced (non-eternal) things, extension is also not eternal. The atomic dimension (*parimaṇḍala*) is eternal and invisible. The eternal *ākāśa*, space

and self are all-pervasive and infinite, while the eternal mind is atomic or minute. Attributes and actions do not have greatness or minuteness and they are also devoid of number. When attributes and actions are brought into contact with sense organs, substance is the cause of the reproduction of conjunction.

In the eighth chapter, the position of the Vaiśeṣika with reference to the total view of the five elements is stated. It is emphasized that no substance has the nature of all five elements. All bodies and sense-organs are of the nature of one or the other, but single element. Earth is the material cause of odour, water of taste, fire of vision and air of touch. The ninth and tenth chapters throw light on the views of the Vaiśeṣika on negation, nature of reason, doubt, consciousness, etc.

The foregoing are the Vaiśeṣika expositions on matter, motion, attributes, space, time, self and mind in the form of sūtras or aphorisms. As already stated, they had assumed the concise and meaningful form even in the pre-Buddhistic period, in any case by about the sixth century B.C.

#### *Greek Science and the Vaiśeṣika System*

In the history of science, the sixth century B.C. has been regarded generally as a period which heralded the dawn of what is familiarly known as Greek science. Between the sixth and the fourth century B.C., in about 300 years, the Greek thinkers showed an unusual speculative activity towards interpreting the world of matter and form. On the one hand there were the pre-Socratics including the Pythagoreans and on the other there were the two great intellectuals, Plato and Aristotle, who developed a natural philosophy which was at once bold and diverse.

One of the pre-Socratic thinkers, Empedocles (c. 494-433 B.C.), is regarded as the founder of the theory of four elements or the 'roots of things' as he called them. Empedocles held that the four immutable and eternal 'roots'—earth, water, air and fire—in different proportions would give rise to a multitude of diverse things. Processes of combination and separation were thought of in terms of opposing principles—love and strife. Later Aristotle elaborated upon it, called these 'roots' elements and introduced a fifth element, ether, which was not to be found in the sublunary world but was associated with the celestial. According to Aristotle the elements were different aspects of 'Primary Matter' or 'Proto-type' each having different qualities. He thought that the different forms were present potentially in Primary Matter and were manifest in four fundamental qualities, cold, heat, dryness and wetness, existing in pairs, each of the four elements having its characteristic pair of active qualities. The Primary Matter would become earth with the pair cold and dry, water with cold and wet, fire with hot and dryness and air with hot and wetness. The mutually contradictory qualities

—hot and cold, dry and wet—were not supposed to enter into any combination.<sup>14</sup> Aristotle also conceived of the four elements in terms of their ‘natural motion and place’ as follows:<sup>15</sup>

Element	Natural place	Natural motion
Earth ..	Centre of the universe	Downwards (towards the centre)
Fire ..	Outermost part of the sublunary sphere	Upwards (away from the centre)
Water ..	Outside the central region	Downwards (except central region)
Air ..	Between those of water and fire	Upwards (except in the region of fire)

Motion of an element other than its ‘natural’ motion was called by Aristotle the ‘unnatural’ motion. He classified the elements into terrestrial (the four elements) and celestial (the fifth element, ether). The natural motion of the terrestrial ones was held to be rectilinear while that of the celestial was considered circular and circular motion was regarded to be the perfect one subject to neither creation nor destruction. The fifth and exclusively the celestial element, ether, was also the component of celestial sphere. Aristotle thought that the heavenly bodies were continuously in their spheres, while the terrestrial ones would always tend to get back to their ‘natural places’.

The elements of Aristotle had even their cosmological positions:<sup>16</sup> earth (centre) was surrounded (in order) by layers of water, air and fire; and then the sphere of ether. Beyond this layer were the seven spheres of planets in succession and the eighth was that of the fixed stars. However, Aristotle did not subscribe<sup>17</sup> to the geometrical thinking of the Pythagoreans and Plato who associated the elements with regular polyhedra—usually referred to as Platonic bodies (earth-cube, fire-tetrahedron, air-octohedron, water-icosahedron and ether-dodecahedron. The last was the quintessence, the element of the heavens).

Among the Greek thinkers, from Thales to Aristotle, some emphasized a single element, like water, air or fire, as the basic stuff of the world while some others stressed a mathematical view in terms of numbers and geometrical forms. There were still others who thought of both atoms and void as reals. Above all were the theories of the four and five elements, and Primary Matter. At the basis of all these different speculations, however, lay a rational attitude or a strict adherence to causality, for the Greek interpretations were noted for their logical requisites and structure of explanations.

The most important point of concern to us is that there was no single system which grew out of them taking into its fold the different rational interpretations. The early Pythagoreans and Plato chose a mathematical tradition. Leucippus, Democritus and their followers clung only to an atomism inclusive of the conception of void. Aristotle, who discarded atomic views, held that the matter was continuous and abhorred void. There was even a cleavage between the doctrine of Ideas of Plato and the concept of matter of Aristotle. In effect then there were distinctly separate views and explanations of the knowable world.

*Schematic presentation of the roots of certain Physical Concepts  
between the Indian and the Greek traditions  
(up to c. 300 B.C.)*

Period	Indian	Greek
c. 2000–1500 B.C.	<b>ṚGVEDA</b> Monistic ideas, Natural law ( <i>Rtam</i> ): Primeval water as the first element	—
c. 900–600 B.C.	<b>UPANISADIC LITERATURE</b> Doctrine of the five elements (earth, water, fire, air and <i>ākāśa</i> ), concepts of space and time  <b>PRE-CLASSICAL SĀNKHYA</b> Evolutionary concepts of matter  <b>VAIŚEṢIKA SCHOOL</b> Substance, qualities and motion; atomism; epistemological roots	—
c. 600–300 B.C.	<b>BUDDHISM AND JAINISM</b> New concepts of matter and motion; atomism finding new adherents	<b>BEGINNINGS OF PRE-SOCRATIC PHILOSOPHERS' SPECULATION</b> Doctrine of single element (Thales, Anaximenes, Heraclitus); philosophy of number (Pythagoreans); atomism (Democritus); doctrine of four elements (Empedocles)



Period	Indian	Greek
	NYĀYA SŪTRAS	PLATO AND ARISTOTLE
	Integrated view of substance including space, time, self and mind clothed with theories of causation	Ideas as norms (Plato); doctrine of five elements; matter as potential and form as actual; concept of unmoved mover; theories of causation (Aristotle)

In the context of the aforementioned scientific ideas, the Vaiśeṣika system seems to command a consideration which it has not received so far. At first glance, it may appear that the Vaiśeṣika is just perhaps one among the many Indian viewpoints. But the system has deeper significance for two reasons: (i) The theory of elements, atomism, ideas on matter, attributes and motion on the one hand, existence and actuality on the other, are integral parts of the system; and (ii) the Vaiśeṣika school, as stated before, had acquired a definite shape and following even before the pre-Socratics began to nurture their seed-ideas. In other words, the Vaiśeṣika school conceived in its own way some of the leading expositions of the Greek thinkers and propounded them together. Besides, if the Greek view is rational so is that of the Vaiśeṣika for there is a theory of causation running throughout the latter.

The Vaiśeṣika system holds that every effect has a cause and there is a relation between the cause and effect even though they are different. The enunciation and presentation of the nine substances, seventeen attributes and five types of actions throw ample light on the causal scheme of the system. The realistic categories of the Vaiśeṣika are based upon the facts of experience and upon the relation between cause and effect as well. The generic category, substance, includes the atomic, the ubiquitous, the finite, the material and the non-material. Even space and time are thought of in terms of their causal functions. The attributes include such diverse qualities as number, distinctness, conjunction and disjunction, intellection, volition, etc. The actions embrace different types of motion and all these are explained in a rational way.

The Vaiśeṣika system also emphasizes a universal *Sattvā*<sup>18</sup>—which proves the notion of existence in the case of the first three categories, viz. substance, attributes and action. Existence is different from each or all of them and this is interpreted to mean that the categories are not extensive, while existence is extensive and different from the essence of substance (*dravyatva*), attribute (*gunatva*) and action (*karmatva*).<sup>19</sup> The *sattvā* is the potential essence of the three reals. This Vaiśeṣika concept, too, is not without its conceptual counterpart among the Greek thinkers—Aristotle projected the concept of potentiality with reference to matter and form, by saying that matter was potential and form was actual.

According to Aristotle, weight is the efficient cause of downward motion.<sup>20</sup> The *Vaiśeṣika Sūtra* categorically declares that 'falling' results because of *gurutva* or heaviness when there is neither conjunction nor self-reproduction of motion.<sup>21</sup> Besides, there is the concept of impetus (*samskāra*)<sup>22</sup> already in a crystallized form in the *Vaiśeṣika Sūtra* and in this respect curiously the Aristotelian dynamics is far behind.

The atomic views of the *Vaiśeṣika Sūtras* deserve a special mention. Even though the sūtras do not give an elaborate and connected account of the way in which the atoms as material cause combine to produce the gross matter, there is enough evidence to believe as we find in the later commentaries that the Vaiśeṣika system was particularly noted for its atomism. The main features of the atomic views of the Vaiśeṣika are as follows: The four elements (earth, water, fire and air) alone are atomic, the atoms of one element being different from those of the other three. Each of the four different classes of atoms has a specific or distinct quality by which it can be distinguished. All the atoms, however, are spherical, indestructible, indivisible and have the minutest dimension (*pārimāṇḍalya*).<sup>23</sup> Thus the atoms of the Vaiśeṣika are qualitatively different in contradistinction to the quantitatively different atoms of Democritus inasmuch as the latter are considered to possess different sizes, shapes, etc.<sup>24</sup> There is yet another difference: Democritus thinks that even soul is made of atoms; but the Vaiśeṣika holds soul to be non-material and mind to be atomic.<sup>25</sup> Nevertheless, both Democritus and Vaiśeṣika have one similar view, viz. the atoms are in eternal motion. According to Democritus, the motion of the atoms is a specific characteristic of atomicity itself and the motion occurs in the great void. The Vaiśeṣika, however, has a different explanation to offer for the first cause of the motion of atoms and that, as we shall see presently, is a part of the limitation built into the system itself.

#### *The internalized limitation of the system*

A question may now be asked: Why was it that the Vaiśeṣika school with its presumed heterodox beginnings and avowed allegiance not only to the reality of the external world but also to the relationship between cause and effect was not able to gather momentum and establish a scientific tradition as we understand it now? In other words, is there any internalized limitation of the system?

It has been pointed out earlier that the notions of *dharma* became associated with the Vaiśeṣika school in course of time. The keynote of Indian life appears to be the observance of *dharma* not only to refine oneself (individually) but even to lead a corporate life (socially). The word *dharma* literally means that which holds together. *Dharma*, if scrupulously followed, is considered to help in attaining the highest values of life through its own

ways which are unseen (*adr̥ṣṭa*). Both *dharma* and *adr̥ṣṭa* have had their imprint on the Indian orthodox thinking, and the Vaiśeṣika is no exception.

In the *Vaiśeṣika Sūtra* *adr̥ṣṭa* has been invoked subjectively as well as objectively. Subjectively, fasting, spiritual living, religious observances and the like lead to the enrichment of *adr̥ṣṭa*.<sup>26</sup> As a result of *adr̥ṣṭa*, pleasure, happiness or fructification of deeds in relation to the self are believed to accrue to the individual. While these ideas in the *Vaiśeṣika Sūtra* are understandable in view of the fact that *dharma* has been accorded a place in the system, it is rather intriguing to find the explanations for certain objectively made observations in the name of *adr̥ṣṭa*. For example, circulation of water in the trees, upward rising of flames, crosswise flow of air, assimilation of food, the movement of needle towards a magnet are stated to be due to *adr̥ṣṭa*.<sup>27</sup> Above all, the first cause of the motion of atoms is *adr̥ṣṭa*. It would seem that *adr̥ṣṭa* has been conceived perhaps as a force, unseen yet necessary for understanding the otherwise inexplicable movements. From the nature of the examples cited above, it would also appear that attempts were being made to observe different types of natural phenomena and there might have accumulated then a significant amount of empirical knowledge. A rational explanation perhaps could not come about as long as the concept of *adr̥ṣṭa* held the field, for such a concept would act as an impediment to a possible search for a naturalistic cause. The Aristotelian position in the case of the upward rising of flames is, as seen before, that it is 'natural' to it and this approach is undoubtedly far better than the belief in the unseen. In the explanation concerning the movement of a needle towards a magnet, the account of Epicurus<sup>28</sup> (c. 340–270 B.C.) is worthy of note. In a naturalistic way, it is explained that an emptiness or void is created between the iron and the magnet and this forces the first 'beginnings' or atoms of iron on the side nearer the magnet to fall into the void and move towards the magnet, iron itself being drawn in this process. If the notions of *dharma* and *adr̥ṣṭa* had not crept into the Vaiśeṣika school, perhaps the empirical knowledge of the time would have suggested naturalistic explanations.

Another probably more important limitation of the Vaiśeṣika school seems to be its divorce from the contemporary mathematical tradition. The Vaiśeṣika has discussed the problem of matter in considerable detail but only with reference to its attributes and actions. Somehow for reasons unknown there is no account or explanation of the forms of the phenomenal world, qualitatively and quantitatively, in the *Vaiśeṣika Sūtras*. The strength of the Greek science lies in its adherence to causality and in the acceptance of a mathematical approach towards the understanding of matter and the forms. Of causality the Vaiśeṣika was a strict follower, but to the mathematical approach it does not seem to have given much credence, even though number is reckoned among the attributes.

In addition, the sūtra form of the Vaiśeṣika system appears to have suffered from an internalized limitation. Later exponents or commentators of the Vaiśeṣika chose to confine themselves to an authoritative interpretation of the sūtras and their cognate or interdependent themes. When the Vaiśeṣika and the Nyāya became united to form the syncretic Nyāya-Vaiśeṣika school there were additions and outgrowths, the important concepts like atomism, space and time receiving significant attention. Nevertheless, they became a veritable ground for polemics and, perhaps, the authority of the sūtras was too subtle to permit a fresh approach to the observed world.

These limitations, apart, the Vaiśeṣika is an important realistic system. The study of the history of scientific ideas is incomplete without a critical appreciation of this system, for it is not a mere historical situation that the Vaiśeṣika presented in some certain concepts at an earlier period and that later there were similar ideas streaming along independently, among the Greeks. It is probable there was then a movement of ideas as people of different countries came together for commercial and other reasons. There are evidences to show that the Greeks and the Indians had sufficient contacts even before Alexander's invasion.<sup>29</sup> Some historians of science have pointed out that the origins of some of the Greek ideas can be traced to India also.<sup>30</sup> It is not suggested here that the Greeks were after all the borrowers of some of the Indian ideas, but it is rather difficult to be indifferent to a historical situation like the one stated above. It is not unlikely that the Vaiśeṣika school with its bold and systematic assertions might have attracted and stimulated the attention of people from far and wide including the Greek thinkers. This aspect of the history of ideas should be studied in greater detail than has been done so far.

#### NOTES AND REFERENCES

- <sup>1</sup> The six orthodox systems which accept the authority of the Veda are: Nyāya, Vaiśeṣika, Sāṅkhya, Yoga, Pūrva-mīmāṃsā and Uttara-mīmāṃsā or Vedānta.
- <sup>2</sup> *The Vaiśeṣika Philosophy* by H. Ui, Ed. Thomas, The Chowkhamba Sanskrit Studies, XXII, Varanasi, 1962, p. 4.
- <sup>3</sup> *Nyāya-Kaṇḍalī* of Śrīdhara, Vizianagaram Sanskrit Studies, p. 6.
- <sup>4</sup> *The Vaiśeṣika Philosophy* by H. Ui, pp. 5-6.
- <sup>5</sup> The Vaiśeṣika system has a number of other authoritative works. Among them may be mentioned *Kiraṇāvalī* of Udayana, *Kaṇḍalī* of Śrīdhara, *Vyomāvati* of Vyomaśivācārya (commentaries on *Prāśastapādabhāṣya*), *Upaskāra* and *Kaṇāda rahasya* of Śaṅkara Miśra (on the *Vaiśeṣika Sūtra*), and *Saptapadārthī* by Śivāditya.
- <sup>6</sup> *Critique of Indian Realism: A study of the conflict between the Nyāya-Vaiśeṣika and the Buddhist Dīṅnāg*, School by Dharmendra Nath Shastri, Agra, 1964, pp. 100 ff.
- <sup>7</sup> *The Essentials of Indian Philosophy* by M. Hiriyanna, Allen and Unwin, London, 1960, pp. 39 ff.
- <sup>8</sup> *Vaiśeṣika Sūtra*, I.i.4.
- <sup>9</sup> See *Critique of Indian Realism* by Dharmendra Nath Shastri, pp. 66 ff; and *A History of Indian Philosophy* by S. N. Das Gupta, Cambridge, 1951, pp. 280-85.
- <sup>10</sup> *The Vaiśeṣika Philosophy* by H. Ui, pp. 30-31.

- 11 *A Historical Survey of Indian Logic*, M. A. Bodas, *JBBRAS*, XIX, 1897, p. 319.
- 12 *A History of Indian Philosophy* by S. N. Das Gupta, pp. 281-82.
- 13 The texts followed here are *Vaiśeṣika Sūtrapāskāra* of Śaṅkara Miśra and *Vaiśeṣika Sūtra* of Kaṇāda, Gaekwad's Oriental Series, 1861. Also consulted are the text and translation in the *Vaiśeṣika Aphorisms of Kaṇāda* by A. E. Gough, Vāraṇāsi, 1873.
- 14 *A General History of the Sciences, Ancient and Medieval Period*, Ed. Rene Taton, Thames and Hudson, London, 1957, pp. 231-32.
- 15 *A Source Book in Greek Science* by M. R. Cohen and I. E. Drabkin, Harvard University Press, Cambridge (MSS.), 1958, 200-202.
- 16 *A Short History of Science* by C. Singer, Oxford University Press, Oxford, 1943, p. 47.
- 17 *A General History of the Sciences, Ancient and Medieval Period*, Ed. R. Taton, p. 235.
- 18 *Vaiśeṣika Sūtra*, I.ii.7.
- 19 *Op. cit.*, II.i.11-18.
- 20 For details, see the translation of Aristotle's *Physics* by R. P. Hardie and R. K. Oaye and of *DeCaelo* by J. L. Stocks, quoted in *A Source Book in Greek Science*.
- 21 *Vaiśeṣika Sūtra*, V.i.7 and 13.
- 22 *Op. cit.*, V.i.17-18; The impetus theory of the Vaiśeṣika has been dealt with in great detail by S. N. Sen in the *Indian Journal of History of Science*, I (1), 1966, pp. 34-45.
- 23 *Vaiśeṣika Sūtra*, VII.1-27.
- 24 *A History of the Sciences* by S. F. Mason, Routledge and Kegan Paul, London, 1953, pp. 20-21.
- 25 *Vaiśeṣika Sūtra*, VII.i.30.
- 26 *Op. cit.*, V.ii.19.
- 27 *Op. cit.*, V.i.15.
- 28 The Epicurean explanation is given by Lucretius in his work: *On the Nature of things*, VI, 906-16; 998-1064.
- 29 *History and Culture of Indian People*, Vol. II. 'The Age of Imperial Unity', Bharatiya Vidya Bhavan, pp. 614-15.
- 30 *A Short History of Science* by C. Singer, Oxford University Press, 1943, p. 8.