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THE INDIVIDUAL IN PROGRESS*

By

PROF. P. NARASIMHAM, M.A., M.E.S. (Retd.)

I. PATH OF KARMA

Introductory

That we should believe that there is a purpose running through the progress of events, especially in the history of man, is quite a natural human tendency which we should try to properly understand and explain, and not explain away. Our arts, philosophies, religions, etc., are intended only to explain such a human outlook on things, and only so do they fulfil their respective legitimate purposes. If, on the other hand, these serve but to dehumanise man, then we can have nothing to do with them. Our knowledge fulfils its purpose only where it gives us a most comprehensive humanism as its final value. To believe in progress means, therefore, to take up a standpoint that is different from the one that merely describes events as though man did not exist. Mere succession of events, however much we may know their order and laws, is of no consequence to us. What we now call sciences generally take up a descriptive standpoint and have only a utilitarian value; they do not touch the depths of ultimate human values. They record successions of events and reduce them to quantitative equations without letting us know why such should be the constitution of the cosmos. Their claim to knowledge is only superficial; we can never get into the heart of things by the mere scientific method. It is hence we have philosophies and religions side by side by which we try to satisfy our deeper humanity, holding such opinions as hypotheses of ultimate values which cannot, however, be proved by the scientific methods. Such are our *ideals* as distinguished from scientific equations and facts. To us a fact stands as a value and not as a mere mechanical complex. We wish to have some sort of a psychological view of the world and look on its physical aspect as subserving our ideals and values. The teleological view of the

*The Principal Miller Lectures, 1939-40.

world by which we believe there must be some ultimate meaning and value in the world-events is thus contrasted with that of the sciences. The idea of progress and faith in it are consequences of the teleological view and not one of mechanism. It is hence man cannot escape being either a philosopher or a religionist—if he wants to retain his humanity. Nature is no longer a mere object: it exhibits a *subjective* side as well to which man, by his very consciousness, more intimately belongs. It is in such psychological side of nature that we are to discover the values of existence. There is no dead matter anywhere except in the fancy of the materialistic sciences. No life or consciousness can come out of dead matter. We believe there is Intelligence behind the workings of nature, as there is behind our own bodily movements. We cannot abrogate this assumption without contradicting ourselves. It is in terms of this unseen side of nature that we believe in Progress and that there are values and ideals for whose realisation we exist as conscious entities here. Philosophies and religions which consider this aspect of nature and believe in values and ideals, should not, however, be opposed to sciences; they should be looked on as complementaries, each taking a different aspect of existence. We believe that everything in nature has two sides like the twain Prakriti-Purusha of Hindu Thought, one expressing the object-aspect and the other the subject-aspect of all existence, inseparable in their unity. To emphasise one side alone gives us only a wrong perspective of reality.

1. *Karma-yoga or the Life of Action*

If we believe, then, that there is a Great Purpose running through the progress of events both in the external world of objects and in the history of man, we mean that such a progress of events is not a mere concourse of successive facts like what the evolutionists take it to be, but is the working out of a Great Plan that must have been at the back of the world at its very inception and of which we can get a glimpse by studying the world-process from a new angle. It is this latter point of view that is adopted in the sacred records of the various religions of the world as well as in the philosophical systems of the great thinkers in all ages. Man, besides experiencing the facts of the world as they occur, also looks back to know where he stands and whither he is moving. He has no satisfaction intellectually or emotionally unless he discovers what lies behind him and what stands ahead of him. He becomes naturally a philosopher. He strives, at least the more thinking section of mankind does, to direct his activities in accordance with what he conceives as the plan in the world-process. He believes in

values and ideals, and looks on facts as the embodiments of such ideals. Values are human conceptions which are read into events and are dependent on the qualities of things. We have our needs in the world which require satisfaction; otherwise the world would not be worth living in for us. From the mere scientific point of view the world appears to be only a barren field of events, and we are reduced to dust from which we are said to have been born. This status given to us by science does not satisfy us as self-conscious beings. We strive to elevate our position from such situation by discovering qualitative values in life. For, man is the greatest product of nature because of his quality of intelligence and not because of the quantity of his material existence. We believe that in the very origin of the world-process the value of existence is sown like a seed, as an ideal, to grow into fulness of being in the course of evolution. Evolution itself means to us such progress, in its *qualitative* aspect. The final word on the nature of existence does not lie with the bare sciences of objective reality which see things only from outside; it is philosophy that tries to probe into the heart of things, to look at them from within and discover what meanings and values they embody for us. Values constitute the life and soul of things. We shall try in these two discourses to study this aspect of value for man in the progress of his life-history in the world. The value of the external objective world does not lie in itself, but in constituting the field or Kshetra for the evolution of Life and the realisation of its ideals. It is thus we understand that a purpose does run throughout the progress of history leading to the fulfilment of what we conceive as the far-off divine event.

Progress being thus considered as the qualitative evaluation of the cosmic evolutionary process, we may now speculate on what the world means to us and how we can realise within it our highest ideals of being. If we try to represent to ourselves what ultimately constitutes the most comprehensive conception of our values, we may say that it consists in the attainment of perfection of being and freedom of Life, that is, of real individuality. To be such a perfect individual is what is meant by describing ourselves as souls or individualised spirits. It means existence in which unerring knowledge and full freedom to choose and act out our own line of life become possible without any conflict with or contradiction of the other life around us, and by which we attain a real status in the world instead of being, as at present, mere phenomenal projections or pictures dependent on the tender mercies of external cosmic forces. It is such a conception of ultimate attainment that

is connoted by the ideal of Mukti in Hindu philosophy. Mukti does not mean, as popularly supposed, an absorption back into an original Avyakta-Brahman from which we are said to have emerged into concrete existence, or a state of absolute rest in a sort of *laya* condition somewhere beyond the reach of earthly strifes and sorrows, or even a sort of eternal residence in a paradise in the immediate presence of a Deity of our fancy and choice. Mukti means a state of real objective existence in this very world that we all experience and know, but without any of the limitations of dependence in which we now find ourselves to be. Mukti is not a subjective belief or state of mind, but existence in the fullest sense beyond any of the evils and sorrows of our present mortal life. With such an ideal of Mukti as the aim towards which human evolution may be conceived as progressing, we shall study here some of the main contributions which Hindu philosophic thought has made on the subject.

The Upanishadic conception of Brahman will naturally be the starting point of such an enquiry. Brahman represents what stands as the One Eternal Abiding Principle or Postulate in which all varieties of being, living and non-living, subjects and objects, of universes and atoms, have their foundation. It is That in which all live and move, but which Itself is not a being along with them. Hence It is undetermined by any specifications that hold true within the cosmos; like space, time, cause, etc., and is simply denoted by the word TAT or That. All our determinations, predications, changes and movements, things and values, have their existence within It. It is therefore sometimes described as the Indescribable, Nirguna. The whole manifest world, the subjective as well as the objective, is within It and there is nothing beyond It. Brahman is thus seen as the highest and all-inclusive category in Hindu philosophic thought. Within Its fold we have the objective world known as Prakriti and the world of Life as subjects, jivas, or Purushas. In the interplay between Prakriti and Purusha which is our world of things and events, we are to discover the meaning of progress and the mode in which our aims and ideals are to be realised. For the certainty of the ultimate realisation of our ideals there is no less a foundation and guarantee than that very Brahman from whom we and our world have come into being.

The allegorical stories in the Hindu sacred literature as also those of other peoples, about the origin of the world, would show that at first It existed as an Idea or Sankalpa somewhat like the Archetypal World of Plato. That original state of cosmic Ideation is described in our books as Hiranya-garbha, or Virat-Purusha. That

origin being ideal in nature was the seed of the world to be, which has now grown into our vast world of concrete forms and varieties of life. It is thus we have the stories of creation as the result of the great sacrifice of the original Ideal Purusha by whose dismemberment all the varieties of life have made their appearance. That original Purusha is the Archetypal Man of whom we are, as it were, the varied progeny, reflections or concrete expressions and manifestations. It is to Him or It that all the course of evolution belongs as the One Energising Principle from which all the activities in the world take their rise. Theologically He is Iswara or the manifest God.

Evolution to the student of Philosophy is not merely "much ado about nothing" which it appears to be to the scientist. Our scientific explanations are only more elaborate and clearly stated *descriptions* of facts and their external relations of sequence and *quantitative* equations. No scientist proposes to know why things, small or great, have come to possess the qualities that they have, or why they combine and undergo change in qualities. The sphere of qualities in which alone man has his main interest and value is beyond the "explanations" of sciences. The origination of qualities is to be sought in the level of Archetypes, the World of Ideas, which constitutes the realm of cosmic Intelligence that the Sankhyas called Mahat or the cosmic Buddhi. We have not yet discovered the method of touching this plane of the origination of things and their qualities. The true causes are the creative principles of that plane; they are *ideal* in nature, everything objective being only an effect. Our phenomenal causal relationships themselves are only consequences of such ideal or creative principles. Progress as the *qualitative* valuation of the phenomena in the world is thus seen to be beyond the scope of the ordinary scientific methods. Yet it is the idea of progress as something true and real that makes philosophy possible and necessary. This view-point of philosophy is sometimes known as teleology, and the teleological method of enquiry is its specific feature so that we look on all philosophical systems as more or less idealistic. Idealism is the name for the study of things in terms of values since values belong to the sphere of 'ideas' of things; it is in contrast to the naturalistic and objective descriptions of sciences. Idealism and realism should not however be opposed as two incompatibles. They are complementary to each other, one representing the life or function-aspect of reality, the other that of being and structure, as objective existence in space-time correlations. The cosmic process of evolution from its origination in the Hiranya-garbha as the *Idea* of the world, and

moving towards realisations as the *fact* of the world, is designated in Indian thought by the word Karma (cf. B.G. viii. 3). In the light of the original "Will to be many" of the Primal Purusha, its progress is to be conceived as aiming to produce perfect individual selves or souls, *muktas* as we should call them, in the end, and also to make the external or objective world a perfect Kshetra or Field in which such *jivas* may find the full joy of existence. Cosmic evolution should be interpreted in terms of this two-fold activity, since neither is possible without the other. At the present stage of such progress both these aspects of evolution present only incomplete pictures, and consequently we have the appearance of various forms of mal-adjustments. We are now only souls in-the-making and the world is an ill-co-ordinated tangle of facts and ideals (values). It is the hope of the student of philosophy that at some future date the harmony of existence both of subjects and objects will be the accomplished achievement of evolution.

The progress in the evolution of the individual towards the attainment of his goal is the subject of our study in these two discourses. We shall approach our problem from a co-ordinated standpoint based on the two important schools of Hindu thought known as Sankhya and Vedanta. Sankhya is mainly concerned with the study of the world on its objective side, i.e., the world as a real object of space-time correlations. Vedanta studies the world more from the point of view of the experiencing subject or Life. Hence, sometimes they are contrasted as realistic and idealistic. But we should not fall into the error of taking these terms in any absolute sense. They should be viewed as complementary only and not as opposed, if we are to derive the benefit of a full understanding of ourselves and the world. There are two expressions in Sankhya and Vedanta literature which are useful for our purpose of understanding how the individual progresses towards attaining his goal. They are known as the paths of Pravritti and Nivritti, expressing the extensive and the intensive mode of interpreting the meaning of progress towards real individuality. Using these terms in a very broad sense, we may say that Pravritti represents the life of outward activity and Nivritti the life of self-contemplation in the evolutionary progress of the individual *jivas*. We shall not oppose them as they are done in the traditional usage. Like the other varieties of philosophic duads, we shall understand them as complementaries and necessary to each other. If separated they become unreal abstractions. We should not start any philosophical enquiry with a postulate of dualistic categories, if we are to achieve unity of thought. The enquiry which so starts

becomes barren leading us to an impasse. Dualisms like those of Purusha and Prakriti, subject and object, good and evil, God and the world etc. lead us nowhere. We should see how they should be interpreted as the two sides of the same single fact of Reality.

Pravritti, according to tradition, means outward directed activity, away from and in forgetfulness or unconsciousness of the individualised centre of life or self, towards the possession of external objects and to change them to suit one's needs. It is the centrifugal tendency of all living beings, and is prompted by instinct for the maintenance of the separated individual and its progeny. As opposed to it Nivritti is the tendency towards the discovery of one's true centre of being, and implies the abandonment of external pursuits and satisfactions arising from the possession of objects. If Pravritti indicates a life of action with an objective viewpoint only, Nivritti, traditionally understood, indicates cessation of action, or *sanyasa*. Nivritti is said to be the life of abstract self-contemplation. Karma, in its technical philosophic sense, pertains to Pravritti, and jnana to Nivritti. The former is connected with man considered as mere animal under the dominance of desires; the latter with man as a soul reflecting on himself. Man is not only an animal, but a reflecting and rational animal. It is because of this special characteristic of man we look on him as having the possibility of becoming a true and full individual, a pure self or soul, capable of an independent or self-sustaining existence. He possesses conscious memory unlike the unconscious or physiological memory of the animal. His life as a full being is both centrifugal and centripetal in its tendencies.

However, as we have just noted, we should see Pravritti and Nivritti not as two opposed tendencies, but as necessary complementaries of each other; we are to understand that the goal towards which man is moving in evolution is one of true and full individuality of being, both objectively and subjectively viewed. If abstracted from each other these two tendencies would destroy the very meaning of evolution and reduce man to either a mere animal or an empty nothing in the realm of existents. The traditional path of Nivritti errs in its extremism. It advocates cutting oneself off completely from the world to enter into a fancied isolation of Kaivalya or absorption in Brahman conceived as the source from which we have come. It thus made many turn to asceticism, abstemiousness and other-worldliness, and to look on this world and existence here as nothing but pain and misery. They sought escape from the world and from birth here as their main aim, and resort-

ed to various forms of religious and pseudo-religious devices for the purpose. This attitude appears to us as pathological and based on an erroneous metaphysics and a wrong perspective of the nature of the world both at its inception and its future culmination. Its vision seems to be limited only to the existing incomplete nature of the world, without any insight into its future possibilities. We should think, rather, that the two tendencies are necessary to each other in order to make of man a real entity. This attempt on the part of man to harmoniously co-ordinate the two tendencies in himself without drifting into the extremes, this endeavour to ever maintain the golden mean between them is the only yoga properly so-called (cf. B.G. vi. 17).

The word Karma, as we have seen, represents in its most general significance, the Pravritti process—both cosmically and individually. It is, however, also used in certain narrow senses which we may briefly consider in passing. One of these meanings is in the sphere of religion. Religious Karma consists of rituals, sacraments and sacrifices, prayers and fasts, etc., which are observed by a people in relation to a god or gods they worship and by which religious creed they hold together as a single people. Karma so interpreted is thus seen to be a socio-religious institution with which we need not be concerned in our present study. Only where a religion gets developed into a philosophic system will it become a yoga of individual progress. But then it ceases to be a religion. It is thus the great philosopher-sages of history belong to no religion in particular. The Upanishadic literature is an example to show that side by side with the Vedic religion there was also a philosophic outlook which had nothing to do with sacrifices, etc., of the popular religion, and which was an esoteric cult of the minority of the intellectuals of the Aryan race.

Another meaning of the term, Karma, is connected with the popular view that there is a moral law of justice in the world by which a recompense is meted out to individuals in the various vicissitudes of life in accordance with their deeds either in the present life or in a past one. By this opinion an attempt is made to eliminate chance and caprice in the allotments of joys and sorrows to persons, and to look on such experiences as the consequences of their past Karma. This view assumes that man, as he now stands, is a free agent or Karta, responsible for his actions as a true individual and could act counter to the Will of the Cosmos. Further it leads into an infinite regress of past Karmas (whence Karma is described as An-adi, beginningless). Such a conclusion makes

the theory of personal Karma untenable and unacceptable on any canons of philosophy. Moreover this theory of personal Karma forgets that, as we now stand, we are only *products* of nature belonging to the realm of Bandha and not true individuals yet to claim real freedom. On the other hand, we should understand that it is only to gain individuality and freedom as Muktas, or liberated souls, that we find ourselves now where we are as Baddhas. We are now like projected picture-shadows with ignorance and unconsciousness surrounding us on all sides without any knowledge of Whence or Whither. Karma conceived as a result of personal freedom of action contradicts the theory of Moksha and the philosophic basis of what is known as Karma Yoga. Freedom is our goal and not the characteristic of our beginnings. The allotments of the various schedules of life to the individual must therefore be looked on as having their source elsewhere than in our personal conduct either in the present or the past. On the other hand, if we accept the hypothesis that we are evolving as one *whole* of life in the womb of the cosmos and that all the experiences of all the individuals will ultimately be to the benefit of all and every individual jiva, we should be properly appraising the work of the cosmos and would not smart under the apparently unequal and unjust distribution of experiences of pleasures, pains, etc. Our present feelings of injustice, etc., in the allocations of life are due to a wrong attribution to ourselves of a status of independent and separate existence for which we do not see any philosophic basis. Further we should note that the cosmos itself is not yet a completed work, but is only what is evolving to be one along with the evolution of the jivas. Our various personal lives—that is, if we believe in the theory of rebirths, that the progress of jivas is worked out not in a single life on earth but by a long series of births—are to be conceived like different roles in different dramatic plays wherein we are sent to act and gain experience and knowledge, and not as what are due to our own choice or any so-called Karmic determinations. It is the Intelligence of the Sankalpa behind the cosmic process that is the real agent in the working of the evolutionary plan. The manner in which we play the part in our schedule of life may *teleologically* determine the assignment or allotment of a subsequent life; but it is subordinate and secondary to the Great Will of the cosmos. There is no causal connection between one life and another like what the popular notion of Karma implies. One might be a king in one birth and a beggar in another, or even a saint in one and a sinner in another, even as one may play the Iago in the Shakesperian drama Othello, and play next the King Lear, without

in any way being himself either of the characters. For, after all, the play belongs to the cosmos and not to us and the characters are only so many garbs in which our Parent Source temporarily clothes us. It is such an understanding of our position in the play that is the spirit of true *Karma yoga* as distinguished from the mere fact of Karma. But for such a central controlling cosmic principle the world would not be a cosmos but an utter chaos of conflicting wills, or even an impossibility.

The above considerations lead us to understand Karma, the life of activity, as a philosophic conception for properly evaluating evolution and not as a matter of any *personal* concern of the jivas that are evolving. There is nothing personal in the sense of something opposed to the rest of the cosmos, anywhere in the world. The personal view is the great delusion of the world. We are now only embryonic souls evolving as wards under the care of our Parent-Principle. We exist together as one whole life. In our origin we exist, as it were, ideally as the Archetypal Man, as the seed-humanity. We are to gain real status of individuality as souls in the end. Such is the meaning of the Great Sacrifice of the Primeval Purusha to become many, at the beginning of the world-scheme. No one can cut oneself off from the total whole of Life that is evolving, without self-extinction. Since it is the Sankalpa of that Origin of Life to *express* Itself as many, the process of our evolution through various forms belongs to It and not to us. Karma is Its creation and not ours. It is hence we are asked to assign or resign all our acts and their consequences to that source which, from a religious point of view, we may call the Deity, and which collectively is the One Life of all of us. Such an attitude of personal unconcern in our acts and their consequences, and the consciousness of the Deity as our One common source is the real spirit of Karma Yoga. It is in that Common Source of all life that all experiences are garnered in order that in the end their value may be distributed to us as knowledge to enable us to live our independent and free life. The whole evolution may be conceived as a great co-operative concern in which each life plays its part, consciously or unconsciously, willingly or unwillingly, for the benefit of the whole and every part. It is this aspect of Karma as the working out of all lives in their togetherness, that is of value to us and not the fiction of personal Karma and personal rewards. The personal jiva is said to be bound by Karma only in the sense that its outlook is not yet universalised, and hence it worries itself about consequences as though they were its personal concern. When the Viveka that all life is one and that there is no separate-

ness or isolation possible for any individual jiva arises, then there comes the joy of transcending the effects of the consequences, and the individual is said to be on the path of Mukti. It is by the very sorrows and pains that are the consequences of the personal outlook that Viveka develops in the individual by which an impersonal attitude is attained. The theory of personal Karma must, therefore, be looked upon as a convenient fiction to enable individuals to perform their duties in the right spirit till the attainment of the universal outlook and detached mode of action by which he rises above the conventional views of good and bad. We are thus enabled to develop the true corporate spirit of life and work for the good of all without any selfish or personal aim. This attitude is what is technically known as desirelessness, Tyaga or Sanyasa. Desire is a technical term in Hindu philosophy used to denote what is sought as a *personal* gain. All actions that are prompted by the emotions corresponding to the separatist type of animal instincts such as fear, anger, hatred, jealousy, combativeness etc., come under the caption of desire in Hindu thought. They do not conduce to develop the consciousness of unity of all life; they detain one in the level of bondage, Karma-bandha, leading one on from birth to birth and the attendant sorrows. They should, therefore, be curbed. It is such an attitude of detachment in our active life that is the first step towards the path of liberation or Mukti; it represents the centrifugal tendency of the jiva harmoniously co-ordinated with the centripetal re-direction and is known as Karma-yoga.

Karma Yoga, as representing the individual's progress through the life of activity, means primarily that we should act out the duties that fall to our lot in the situation we find ourselves in in society, in a spirit of personal detachment from the consequent pleasures and pains and a devout resignation of our actions and their fruit to Deity as the one source of our being to whom alone our allotment of life, its activities and their consequences properly belong. We are only workers here to act under Deity's control, and not authors. In fact it is Deity Himself that is the innermost core of our being and is manifest as the many in the world of life. As the Bhagavad Gita puts it, He is the One Kshetrajna-Purusha reflected in all the forms of life or Kshetras. Since metaphysically speaking all reality is one only without another (*Advitiya*), there is no philosophical basis for taking any individual life as a distinct and independent entity beside the One Supreme Self. The attitude of the Karmayogin will give a peace of mind and joy in life that no amount of the amenities of life spontaneously coming to an individual with the separatist consciousness can ever bestow. The for-

mer attitude represents independence of external surroundings while being entirely dependent and linked up to the One Source of all beings; the latter represents just the reverse, a pitiable dependence on external chances with no consciousness of one's real position in the world-scheme. The former represents the Sthita-prajna of the Gita; the latter is the opposite, Avyavasayatman.

What we mean as the moral progress of the world should be understood as the result of the contributions made by the various persons in their life-experiences from such an impersonal point of view to raise the value of existence so that there should result a complete co-ordination of our ideals with facts. It is a constructive and creative work done by the jivas themselves, and is not of the nature of external determination. Just as at present the jivas are not perfect individuals so also the world is not yet a completely ordered moral cosmos. It is to be made into an ordered whole by our conjoint effort; for we ourselves are, in our ultimate nature, expressions of the Supreme Spirit and it is that Supreme Spirit Itself that must be understood as working in and through us. It does not act from outside as something external to us, but as the innermost core of our very being. It is at once the world as Kshetra, and the individual Purushas. We thus see the supreme importance of the attitude of Karma Yoga for bringing about the moral order in the natural world. Any trace of the personal egoistic element in our behaviour will spoil the harmony of the whole. It is only the consciousness of the utter unity of all life, that we are only expressions of One Life, that can bring about the realisation of our ideals of existence. All the gains and losses reaped in the individual lives belong to that whole life that is our Parent Source, and thus belong to us all and to no one in particular. The saintliness of the saint and the sinfulness of the sinner, the wisdom of the wise and the foolishness of the fools, all belong to us all and every one of us. Error and sin are to be understood to be only defects and privations. They exist along with their attendant sorrows in this uncompleted world only to be removed by the creation of positive values of knowledge and goodness by the co-operative endeavour of ourselves in the evolution-process. The true sage does not therefore judge others at their face value as though they were individual persons solely responsible for their acts (cf. B. G. v. 18). He shares the responsibility along with them and works for the welfare of all and the eradication of evil. Such a sage alone is the true Buddhi yogi whom the Gita extols. It is to develop the consciousness of the unity of Life that the active life called the Karma-yoga prepares the indi-

vidual. Pravritti thus transmuted into Karma-yoga leads one towards its own co-ordination with Nivritti or Jnana-Yoga whence the complete individual as a real soul is born. The life of a true yogi, therefore, cannot be selfish or directed to his own salvation, but is for the good of all.

The traditional Hindu doctrine of Karma yoga, namely that we should dedicate all our life-activities along with their results to Deity in order that we might avoid Karmic bondage and attain salvation will now be understood in its proper light. We should not suppose that rebirths and predetermined schedules of life are evils *per se*, or that the *Summum Bonum* of life consists in merely effecting an escape, each for himself, from the clutches of these two factors. The real aim of evolution is a positive attainment of divine eminence for the whole human life, and not a negative avoidance of the existing conditions of life on earth for any particular individual. Rebirth is the one means by which the evolution of life works out its plan; and pre-scheduled lives under the control of our Parent Principle are the only guidance that can bring about the Great Consummation for the present embryonic humanity that is evolving towards its full stature of being. These two modes of evolution are not evils. If we are to act different and unconnected roles in the cosmos so as to gain varieties of experience, then it is natural that we should appear as different personalities or characters in different psycho-physical bodies in our various lives. The parts that we are to play in each will represent the varieties of actions that are allotted to us by the Origin from which we have come into being, in order that the whole scheme may work on a co-operative basis. Forgetfulness of our past lives will be understood as a merciful natural contrivance to enable us to act efficiently the new roles assigned to us, and not as a handicap in our evolution. For, as we have already noted, the parts we play in the total scheme are not really ourselves but only assignments given us by Deity who alone is the One metaphysical Self working out His Sankalpa to manifest as the many. Hence the requisite Viveka implied in Karma-Yoga that we should dedicate our lives and our activities along with their fruits to Deity. Evolved, as we are, like animals, we are now under the dominance of the instincts of the separatist life known as Kama-Krodha. As self-reflecting and conscious beings we should try to transcend our animal characteristics and transmute our merely human nature into one of divinity by the knowledge that we are only expressions of One Life and One Spirit. Such is the significance of Karma-

Yoga and the Viveka-enlightenment underlying it, for the progress of the individual through the life of activity into real individuality.

Next, as a corollary of the view that we are all evolving as one whole human life and that all our Karmic activities belong not to us severally but to the One Origin of us all to whom alone they should be dedicated, we have the conception that the dignity of the Mukti-state attained in any individual in the course of evolution belongs to us all alike. For, just as the Karma of all belongs to all as proceeding from the same single source wherein they are pooled and their fruition is distributed to all alike, so also the divine excellence of Mukti does belong to all in the human group and to no one in particular. The unity of all life in the One Source entails such a consummation. There is no room for any one to remain in isolation as a mukta. For, what really exists is Deity alone and It is the All. Isolation from It is unthinkable; it is a self-contradiction and means only extinction. It is also to be remembered that the excellence of Mukti in any individual is what is possible only because of the collective efforts and co-operation of all the jivas in evolution and not what is achievable by the efforts of any jiva in isolation. Mukti is not to be imagined as a kind of abstraction of being by a re-absorption into the origin of existence, the Primal Avyakta, as some hold it to be. We have already noted that that origin has itself become this and no longer exists as that original somewhere in a remote place. Just as the seed which represents the origin of the tree becomes the tree in the end, so also the origin of our life starting as the seed, the so-called Hiranya Garbha or Virat, the Archetypal man, has become the humanity that we now are. The concept of Brahman, as we have noted earlier, does not refer to something to which we can go back; It is intended to mean the Eternal Foundation of all being, of all forms and life. It is a wrong perspective of reality to suppose that the end of evolution is to go back to the unmanifest ideal condition from which we have emerged. It is to become fully manifest, to be more and more, that is the Sankalpa behind evolution. Such being the aim of Evolution the mukta, as its ultimate fruition, represents by his very presence a Spiritual Force which transforms the world-scheme into a perfect order just as the legendary philosopher's stone is said to turn every base metal into gold by its contact. To be a mukta means to be entirely pure. The purely pure does not get soiled by contact with the base but turns the base into the pure. Such a mukta is yet to emerge, when along with him our changing mortal world will become the immortal

world, the dream of heaven being established on earth, by his bringing down to earth the universalising Brahmic Principle as a real functioning factor for the benefit of the whole humanity.

It might appear, on a superficial view, that in describing the nature of the individual's progress through evolution as what is ultimately due to the impulse from the Original Source Itself and not to that of any individual, we take the individual as of no account, as a mere non-entity, with no endeavour of his own towards his moral progress. But we should remember that true individuality is what is to be attained as the fruition of evolution in the end and not what we possess already. We are now only in the position of wards in the cosmic scheme: we are like the growing embryos in the womb of nature. It is her life that we live, and not our own yet. All the achievements of mankind in its evolution are to be interpreted as what were and are due to the impulses from the Origin of Life as their real cause and not what are due to anything that is done by mere men. The various stages in the progress of evolution are effected through individual men by the Cosmic Forces themselves working through human mediation. Hence in history they come to be known as founders of civilization, Teachers of arts and culture, Saviours and Avatars and builders of law or order. There is nothing that is individual and personal with any one of us due to any special favour of Deity to whom we are all alike and who is evolving us all to the same level of perfection. We should never forget that there is only One Life working as the one Self of all selves and no one can put oneself as an 'other' to that Life. All our endeavours and their results belong to that Supreme Self known as Paramatma and not to ourselves as separate entities. Any element of false Ahankara in us will meet only with its own *reductio ad absurdum* in the cosmic scheme. No one who rightly understands his position as but a part of that Great Life, will be morally able to act amiss or wrongly. Evil or sin is only a consequence of ignorance of the fact of the unity of all life. It is psychologically impossible to consciously deceive oneself. It is Deity Himself as the One Life within us all, that in accordance with His Sankalpa to be the many, is working towards progress from *within* us and not as an external being. The true progress of man, morally as well as in other respects, lies in thus understanding oneself as an expression of the Great Spirit and acting in that light, not as a separate individual entity opposed to it. Vedantic ethics postulates no other ideal of active life than such an understanding and living out the one-ness

of all in Brahman. As the Upanishad says "where is delusion or sorrow to one who sees the unity of all (in Brahman)?" Such is the nature of Karma lived as Karma-yoga that functions as the centrifugal tendency making for progress towards true individuality.

II. JNANA

The Life of Contemplation

In the preceding discourse we studied the nature of the Life of activity as yoga through Karma that prepares one towards the attainment of real and perfect individuality of being. The other aspect of the individual's progress, namely, the life of contemplation and self-reflection as yoga through jnana, we shall now take up as being concerned with the attainment of a clear and direct knowledge of one-self, when alone any one has the right to call himself a soul. As we have noted in our earlier study, the two lines of progress should go together. They should not be abstracted from or opposed to each other. Knowledge and action are to be understood as being but the two sides of one and the same fact of Life. We should not fall into the error of looking on these two lines of endeavour as two divergent and antagonistic paths of life like what some Vedantins take them to be by calling them by the names—Pravritti and Nivritti. They are the Sankhya and Yoga of the Gita which are said to be *one* only (B.G. iii. 3; v. 5).

All knowledge is described in the Hindu Vedantic thought under the two headings of Vidya and Avidya. There is also a distinction made between Jnana and Vijnana, which, however, is based on epistemological grounds. Avidya has a technical meaning. It does not indicate ignorance in general, as commonly supposed, but the absence of a special type of knowledge known as Vidya by which the individual is said to attain salvation. Cf. "*Avidyayā mr̥tyum tirtvā Vidyayā amṛtam aśnute.*" While the distinction between Vidya and Avidya has an ontological basis, the distinction between Jnana and Vijnana seems to be connected with the difference between the conceptual and perceptual varieties of knowledge. By concepts we unify facts of our experience; by perception we distinguish things by their sense-qualities. Vidya has to do with a direct and intimate mode of knowing things in their essence, that is, with the noumenal knowledge; it leads one to understand how all the facts of the world are rooted in the one Eternal Reality of Brahman-Atman. Avidya is concerned with

the external or objective aspect of things obtained on the basis of distinction between the "subject" and the "object" as two "opposed" factors, so that the world presents itself in its diversity, plurality and external relationships. In other words, it is the knowledge of the Prakritic aspect of Reality, sometimes known as the Maya-view of the world. It is thus that Avidya is identified with what is called Maya by the Advaitic Vedantins.

In every act of knowing we distinguish three factors, the knower or the subject, the known or the object and knowledge. The knower is the individual Self or Purusha. He knows the world as "object" through the mediation of certain instruments or *karanas* which Nature or Prakriti (which is itself the object cosmically considered) has endowed him with in his psycho-physical organisation. Thus the Sankhyan cosmology tells us that Buddhi, Manas and the Indriyas are the *karanas* by means of which the external products of cosmic Prakriti are known. Knowledge is the result of the contacts between the Subject, Purusha, and the Object, Prakriti, through the mediation of these instruments or *karanas* of knowledge. These means of knowledge are the special modifications of Prakriti itself in the individual's organisation corresponding to the modifications of Prakriti in the external world. It is by such correspondence between the microcosm and the macrocosm by reason of which the instruments of knowledge and the external world of objects have the same origin, that knowledge is possible. The man-form is thus considered as a sort of miniature reproduction of the cosmic constitution. The Sankhyan doctrine of Tanmatras refers to such a common origin of both the senses and the external cosmic elements. In Platonic language, the Tanmatras are the Archetypal causes of the constitution of both the macrocosm and the microcosm. Without some such theory of common origin there can be no reason why and how knowledge is possible. Manas is the principle that co-ordinates the sense-organ activity into perceptual judgments by which the variety of the external objects is known. It is hence called the "internal sense," *antahkarana*, standing midway between the senses and the higher synthesising faculty of Buddhi. Buddhi is the reflection of the cosmic Ideation or Mahat in man, by which we are able to work out concepts for the unification of our knowledge. The Sankhyan Mahat is the same as the Platonic World of Ideas or Archetypal causes. It is the creative source of cosmic evolution. What is technically known as Jnana in Vedanta is thus seen to be the function of Buddhi, and Vijnana that of Manas.

Knowledge means a correct apprehension of our environment and our position in the world. By knowledge alone it is possible for us to live to the full import of existence. All the ultimate values of life are based on the foundations of knowledge. Even virtue becomes real virtue only when founded on knowledge. Virtue is knowledge as the ancient Greeks expressed it. Vedanta says that the culmination of all endeavour is knowledge and one possessed of knowledge can never act amiss (cf. Gita: iv 33; vii 18). Truth as knowledge is not, however, as commonly supposed, a kind of photographic representation of external objects in our minds. To know is an act of our intelligence, a *meaning* that we read into what is presented to us. This meaning does not come from anywhere outside us; it is the reaction from within us by that principle of cosmic intelligence that is reproduced within our psychic constitution as Buddhi and which the Sankhyans called Mahat; or as Plato described it, by our sharing in our intellectual nature the cosmic world of Ideas prior to our taking bodily forms. Without such correspondence of nature between the microcosm and the macrocosm by the very fact of our having evolved out of the cosmic activities themselves, it will not be possible to understand why we should be capable of knowing or why the world should be known. Nor is truth what results from a shifting process of testing by experience as the scientist who works by hypotheses supposes it to be. Knowledge that is absolutely certain in the Vedantic sense is the result of a *direct* method of knowing, as we shall see later on. What the scientific method of knowing through the process of logical induction gives us is only an indirectly obtained assumption that is liable to change with further experience. There is no finality about such knowledge. Nor again is truth a mere result of internal coherence and self-consistency. This method of arriving at certainty is also an indirect procedure like that of the Pragmatists and lands us in metaphysical solipsism. All the standards of truth-value that come under these main headings are empirical, indirect and negative. Sciences themselves are only varieties of empiricism worked out by elaborate observations and analyses of the phenomena. The scientist merely records the *sequences* and suggests hypothetical relationships between them and calls these 'laws of causation.' The scientist does not claim to know why things should behave in the manner they do as causes and effects, or how they came to possess the qualities they have. The scientist assumes that the ultimate elements of matter are evolved from out of an original non-atomic homogeneous stuff whether of the nature of ether or energy; but how and why these elements have evolved

or why there should be any evolution at all is not revealed to him by his methods. The secret of the evolution of qualities and things, according to Hindu thought, belongs to the Mahat aspect of Prakriti, i.e., the Cosmic Intelligence. Until the individual's own Buddhi is brought into *rapport* with this cosmic principle of Mahat, the secret of the evolution of qualities will not be known, and until this is known there is no certainty or finality in human knowledge, no knowledge or science worth the name.

It follows from the above considerations that the human faculty of intelligence is constituted by Nature herself to know. The real epistemological problem, therefore, is not why and how we know, but why we commit error or fail to know. To understand this problem of error we have to examine how far our psycho-physical constitution as evolved by nature so far is an accomplished work. We notice on every side that nature is not yet a perfectly finished field or *Kshetra*, but that it is evolving to be so. It is full of maladjustments and defects. The process of evolution, especially in relation to our body-organisation, is still going on. It proceeds by the process of trials, experiments, failures and retrials, destroying what is found to be defective and beginning again new methods of construction. It is thus we are to understand the cycles of evolution described in the Hindu Epics. The aim is to bring about a suitable organic constitution which can live and act as a perfected entity, a true individual and a real miniature reproduction of all that the cosmos contains. We are evolving to be such real microcosms. If the original Sankalpa of the world-process be represented by the concept of the Archetypal Man, then we can understand that all the lower organic evolution is only what is intended to bring about the existence of the man-form as the crown of its work, a being who is capable of perfect consciousness of himself and thus act as a true expression of the cosmic man as a real entity. At present we are only incomplete beings. We are still in the process of formation and do not possess in any conscious way all the wonders of the cosmic principles. Hence we are now only fallible beings and are prone to commit many errors. The external world also is not yet a perfectly ordered cosmos in which all the fundamental values are well co-ordinated and harmonised. Error thus can be seen to be a passing incident in the evolution of knowledge, and will ultimately disappear in the end just as, we might hope equally, evil also would and should disappear. Error and evil are only forms of *privation*, and are two aspects of the same fact of uncompletedness in the cosmic evolution. To know and to know infallibly, to act and to act rightly, are to be conceived as

the birth-rights of man as the aim of evolution. But whereas in the lower orders of life, it is the cosmic intelligence itself that pushes up the evolutionary progress, acting, as it were, from outside the organisms through what are called instincts, in man this progress is done from within the individuals by the characteristic of self-consciousness and a knowledge of ideals and values. It is hence man is said to be constituted in the image of the Deity, i.e., to be a real microcosm. At present, because of the limited nature of our being, our knowledge is of an indirect nature, arrived at by trials, errors and rectifications. Hence this kind of knowledge is known as Avidya. It is a knowledge of the changing forms and external relations with no insight into the abiding nature of things or any contact with the 'soul' of the world.

What is called Vidya in its technical sense, the real jnana of the seers and the yogis, is knowledge that is certain where no doubt is possible, and which is attained by a different method altogether. It is not obtained by any external observation and hypotheses where the "object" stands as an *other* to the knower and remains different from him. So long as the object remains as something separate and distinct from our consciousness, it baffles our insight into its nature. We can have only an 'outside' view of it; we do not know it but only know *about* it. This is what is, epistemologically speaking, in the language of Vedanta, the Maya appearance of the object. The object itself remains a mystery to us. The relation between the knowing subject and the object to be known remains unbridged. But if by any means it becomes possible to put ourselves right into the heart of the object, as though, for the time being, we have become the object itself and thus know it as verily ourselves, then such an intimacy of relationship with the object must give us an intensive and immediate knowledge where no doubt is possible. Only by such means can the "otherness" of the object to be known be transcended and the object become known as such. Such is the nature of direct knowledge. It belongs to a higher level of consciousness than the mediate knowledge of our normal ratiocinative thinking. Until such direct knowledge becomes possible for us we have only doubts and conjectures, and are liable to err. Even where error is removable by careful observation and experiment, ratiocinative knowledge remains non-intimate, indirect and external, and will not represent the true nature of things, the real *gnosis* or *jnana* that the ancient thinkers idealised and strove for. Vidya and Avidya are thus seen as belonging to two different dimensions of knowing. To borrow a simile from the story of the book of the

Genesis, while the latter kind of knowledge results from the tasting of the fruit of the tree of Good and Evil, that is, of the world of distinctions and differences—the cosmos itself being compared to a tree—the former is the result of tasting the fruit of the tree of Life itself.

Man is primarily a reflecting animal; he is able to look back to understand where he stands in the scheme of things and to look ahead whither he is moving. He alone is thus a knowing or rational animal. The animal simply moves on impelled by its instincts. Both its actions and perceptions are instinct-prompted. That is, it is guided, unlike man, from outside, as it were, by the cosmic Intelligence, and for which no *centre of reference like a self* as in the case of man is yet formed. Hence its promptings are known as instincts whereas in the case of man we speak of his actions as guided by his reason or intelligence along with a consciousness of his own which he calls "himself". Instinct is not what is conscious of itself; the human intelligence is more or less conscious of itself. Man is a developing individuality and is a soul in the making. What is known as intuition in man by which sometimes correct judgments are made, is only an unconscious faculty akin to instinct. No one has any knowledge of his own intuitions. So long as any form of unconsciousness exists, man is not to be considered as a true individual or soul; he remains merely a dependent being like the animal subject to external influences. Intuitions, thus, being only unconscious factors, have no absolute certainty about them; they are not knowledge in the proper sense of the term. The great majority of men are yet instinct-prompted both in their actions and their perceptions. It is thus, for example, we become angry or afraid by an unconscious or physiological impulse. Our sense perceptions are also a variety of instinctive reactions. We are ignorant as to how or why such impulses arise in us, for the simple reason that our body-organisation is what is *given* us by nature and not made by ourselves. We are bound by its determinations and strive to make the best of it (cf. B.G. iii. 33). Hence the function of Karma-yoga as a preliminary training.

Vidya is the name traditionally given to that knowledge by which man is said to attain to a *direct* consciousness of his spiritual nature, that is, that he is in himself a Soul or Purusha, an immortal entity. In Vedanta the word has the technical meaning of the knowledge of the unity of oneself with the Supreme Spirit, Paramatma or Brahman, conceived as the one Fundamental Principle of all existence. From the point of view of such direct conscious-

ness of the unity of all in Brahman, Vidya is in contrast to Avidya which represents that kind of knowledge by which things are distinguished in their severalty alone. Avidya is thus not ignorance; it connotes what is not Vidya. It means knowledge of the Prakriti aspect of Reality, of differences and inter-relations by which objects as making up the multiplicity of the world are known. The contrast between Vidya and Avidya is well illustrated in the dialogue between Narada and Sanatkumara in Chhandogya Upanishad, Ch. VII. Avidya is our normal relational knowledge; it is like what Kant described as knowledge coming under the categories of time, space, cause, etc. Vidya will then be like knowledge of things-in-themselves, or rather of the Thing-in-Itself as the Upanishads would put it. Avidya comprises the world of "name and form," i.e., of ideas and facts, of the physics of reality as distinguished from Vidya which is the metaphysics of the world, pertaining to the soul-aspect of things. But we should not suppose that the knowledge of "names and forms" is either ignorance or worthless as some extremist Vedantins seem to believe. It only means partial knowledge which would not give any insight into the wholeness of the world; it should not take the place of Vidya. Avidya is differential knowledge giving us a discontinuous view of the world. The saving knowledge of Vedanta is Vidya and not Avidya. One realises by Vidya one's spiritual unity with the Spirit of the world and thus is said to attain immortality by transcending change and mortality. Hence, as we have noted earlier, the Upanishad says, "*Avidyayā mṛtyum tīrtvā, Vidyayā amṛtam āśnute.*" Avidya is consequently described as Maya or phenomenal knowledge. It is also called Ne-science epistemologically, and ontologically is identified with the objective and discontinuous world of Prakriti or Maya. Our modern sciences, like the variegated knowledge of Narada in the Upanishad, belong to this category of Avidya or Ne-science. By saying so we do not mean to belittle the value of sciences as such; they have their own scale of values. We only mean to say that the highest aim of human evolution will not be attained by this so-called scientific knowledge. The ultimate nature of things, how they came to possess the qualities they have or how differentiations originated, cannot be had by the scientific method. Only where man realises his own ultimate nature as spirit, and thus knows directly his *one-ness* with the Ultimate Principle of the world itself, do we have Vidya by which we shall also know the world *in its essence*. Vidya puts one directly into the noumenal world, the world of Ideas and Archetypes where no illusion or delusion has any place. It is knowing the soul of things by one's own soul.

When we say that we have known a thing there is the implication that the object that is known must have already been in existence prior to the act of our knowing it. Knowledge presupposes the existence of its object. The cause of the being of the object is independent of the knower. To know, therefore, is only an act of discovery by us. To suppose that in knowing the object we bring it into existence would be like the attempt to eat one's own head. The ability to know is, as we have noted, inherent in our psychophysical constitution. Truth and error epistemologically, and the real and the unreal ontologically, are terms whose significance is within the realm of human understanding. There is no such thing as absolute error or absolute unreality. Error is only partial truth taken as though it were the whole truth. What is called the unreal or *asat*, simply indicates what cannot be, because it is the impossible or the self-contradictory. It does not mean any "fact" that is opposable to *Sat* or the real. Error results from a defect in the functioning of the faculty of our understanding. Our knowledge is also sometimes described as being only reminiscence or memory (*smṛiti*), in the Platonic as well as in the Vedantic view. All knowledge is said to be potentially, that is *ideally*, existent in our intellectual faculty whose source is the world of Ideas according to Plato, or the cosmic Mahat according to Sankhya. It requires only the incidence of experience to make itself manifest or patent as our actual knowledge. Just as a seed is only the possibility of a tree, so also is the faculty of our intelligence; it requires the environmental influence to be a real fact.

The term *jñāna* in the Vedantic sense is used specially to refer to the Self or Atman as distinguished from the changing Prakriti. It thus becomes identical with Vidya, and Ajnana as Avidya becomes the same as the knowledge pertaining solely to the workings of Prakriti in utter neglect of the self. Since, however, we should not abstract the subject (atman) from the object (Prakriti), and since the two are only one in the concept of Brahman, we should not make of the opposition between Vidya and Avidya absolute if we are to attain to the whole truth of Reality. Extremism whether it be the unworldly narrow form of Vedantism or scientific materialism, lands us ultimately in confusion and an *impasse*. We must understand that we are progressing on in evolution to become real and full entities and not abstractions. Atman as an abstract self without form or definiteness of its own as an individual is simply unthinkable. The world-process itself would be a lie and deceit, if 'form' should have no value for individuality and spirit should

be conceived as existing by itself. The very meaning of the word Atman belies such abstractedness.

What Jnana means is described in the Gita Ch. XIII, 7-11. Whatever is not mentioned in that list is called Ajnana, that is what is not Jnana. In those verses we have a combination of both moral and intellectual qualities, and the reason for such mixing up appears to be that all virtue is the result of real knowledge. The essence of such knowledge is clearly declared to be that of the One Brahman in all and all in Brahman. Brahman is the greatest synthesis of all existence and reality, what was and what will be, in which all the "limitations" and forms of definiteness like space, time, cause, etc. exist but which Itself is not conceivable in these terms. Such is the special meaning of Jnana as Vidya. Apart from this special connotation of the word, we have the normal human variety of understanding coming under two headings as Jnana and Vijnana. The prefix 'vi' in Vijnana means anything specified or qualified. Vijnana means, therefore, a different aspect of knowledge, i.e., of knowledge of things qualified by distinctions or *viseshas*. That is, while Jnana is the function of the Buddhi-principle in man by which concepts are formed to bring together the various aspects of our experience into a coherent and self-consistent system, Vijnana functions as our perceptual thought and makes judgments out of the various impressions given us by the externally operating sense-organs by which we distinguish the things of the world. It is the principle of Manas that is connected with Vijnana and by it the variety of external world is known as such. Manas is sometimes known as the internal organ of perception, *antahkarana*, by this special characteristic of receiving sense-impressions and welding them into percepts. Its characteristic is thus connected with a going-out, Pravritti, by which the world appears as an object or projected picture beyond us, whereas, in the case of Buddhi it is more an inward activity of concept-construction which ultimately results in considering the whole world including ourselves under a single concept. Buddhi is thus seen to be more intimately connected with the Nivritti type of knowing. In the case of the lower animal it is the Pravritti that is the main feature, while in man it is Jnana of the centripetal variety that is the specific character of his knowledge. The Buddhi-principle thus appears to be the special human characteristic. Man mostly lives—at least civilized man—in the conceptual level. If Pravritti alone is seen predominant in men, it means that they are more animal than human. However, we should note that both Jnana and Vijnana are needed by each

other in order that our knowledge may be expressed as a system in all the richness of its content. Unity and variety can only exist together in human knowledge, that is, above the level of the mere animal instinct. If abstracted from each other they will have no human value at all. Without Buddhi man would be only an animal, and without manas he would be like a plant or even a mineral. It is possible also to conceive of a still higher-level-function of Buddhi and Manas in super-men where side by side with the proper perspective of the objective reality there is also an intimate consciousness of the unity of all life under the supreme category of a concept like the Upanishadic Brahman. The principle of Buddhi as a reflection in man of the cosmic Mahat has not yet become fully manifest even in the best and highest types of men that we have so far known in history. It is to the future evolution of man that we have to look for a sample of such an individual. It is in such an individual that there will be found a harmonious blending of Jnana and Vijnana, of the centripetal and centrifugal functions and the fulfilment of the destiny towards which mankind is evolving.

The two directions of life that we have been describing as the centrifugal and centripetal functions and which are described in Hindu philosophies as Pravritti and Nivritti, when properly co-ordinated into a harmonious unity of life, evolve the individual into the true individuality that the word soul naturally connotes. The endeavour to co-ordinate them is what is called yoga proper. From the point of view of Pravritti it is Karma-yoga; and from that of Nivritti it is Jnana-yoga.

Yoga is a term with various meanings. It is generally used to refer to the endeavour to attain complete consciousness of oneself and thereby to control one's own destiny, that is, to the perfect co-ordination of all the principles that constitute one's bodily existence to serve as one's vehicle of expression. By such endeavour it is implied that man is an *ideal* miniature of the cosmos and that he can therefore realise in life the fulness of being that the cosmos has intended in bringing man into existence. The whole of the cosmic evolution may itself be conceived as the great yoga that the Intelligence behind it is working at—i.e., what we have described as the Sankalpa of the Deity to manifest as the many. The term yoga is also sometimes used with reference to ordinary matters of our life like bringing about a synthesis of a number of different elements to achieve a particular end. We shall confine ourselves here to one definite meaning of the term, namely, the endeavour of the individual to attain to perfect unity

of being by means of what we have described as the harmonious co-ordination of the two fundamental tendencies of Pravritti and Nivritti, without allowing himself to drift to either of the two opposite extremes of becoming an extrovert or introvert. It is a golden mean that the yogi endeavours to attain between any two extremes. There are some writers, however, who used the term in the sense of separation or isolation from the entanglements of Prakriti, so as to attain unity with what they fancied as an original Paramatman or Brahman, as though there were two separate absolutes like Brahman and Prakriti. We shall not fall into this trap of dualism. We must understand that the ultimate reality is one only, *advitiam*, and all variety of existence must be understood to be within It and not existing along with It. The Upanishad says that he who sees variety alone, goes from death to death, and never realises the deathless state. The pairs of terms, subject and object, matter and spirit, etc., if separated from each other become empty abstractions and unreal. The real is what exists both as an object amidst objects and as a subject amongst subjects. To borrow the expression of Spinoza regarding perfect knowledge one should become conscious of oneself too as *sub specie eternitatis*. Whatever or whoever cannot be so conceived belongs to the realm of phenomena or Avidya and not Vidya. Yoga is just the endeavour to realise this Spinozistic standpoint of consciousness with reference to one's own existence when alone one becomes established in the Eternity of Being as an individual soul.

In our study of Yoga-Sadhana we may make use of three fundamental conceptions from what we have extant as Patanjali's *Yoga Sūtras*. We should not be understood, because we are adopting these expressions, as commenting on the system of Patanjali, but only as utilising the significance of these terms for our purpose from the standpoint of the aim of human progress that is upheld here. These conceptions are (1) Yoga as *Chitta-Vritti Nirodha* and the consequent turning of attention on oneself, (2) *Samādhi* or the intensive consciousness of oneself, (3) and the process of *Samyama*. The various levels of consciousness known as *jāgrata*, *svapna*, *sushupti* and *turiya*, we shall also consider in the end incidentally.

Yoga as a sadhana is primarily concerned with training oneself as a conscious entity or subject to attain full consciousness of oneself and to know one's own fundamental nature. It is a variety of psychological study, quite distinct in aim and method from what is known as psychology in the West. It is an investigation into

the nature of oneself as Atman. It is called Atma-Vidya, and from an ontological point of view it is Brahma Vidya. Yoga-endeavour is possible only in the embodied state and not as a disembodied being. Hence we have the incidence of body training, cleanliness, good health, healthy food and living and moderate habits with no extremes of indulgence or abstemiousness, etc., as the prerequisites of yoga practice (cf. B.G. vi. 10-24).

The expression *chitta-vritti-nirodha* should be properly understood. Chitta represents that aspect of our consciousness by which we attend to any definite object, physical or mental, to the exclusion of other objects. This selective nature of our attention becomes the first part of self-discipline. The natural tendency of our attention is to be drawn outwards. Chitta-vritti thus is the same as Pravritti. For one endeavouring to obtain self-knowledge, that is, to take to the Nivritti direction, the chitta-vritti requires to be controlled instead of being allowed to run in its own way; it must be directed towards oneself as Subject. Remembering what we have already noted, viz., that we should not separate Pravritti and Nivritti since we require to know both the external world of objects as well as ourselves as subjects in order that we may develop into full individuals, we may say that the first step in yoga sadhana is *chitta-vritti-nirodha*. This endeavour should not be interpreted as any attempt at the complete suppression of all thinking or consciousness. Such suppression leads only to putting oneself into sleep by a sort of auto-hypnotisation. The ideal function of consciousness is to be fully wakeful, and to attain to a state of *Jāgrata* in all the levels of being. Unconsciousness can be induced even by the action of drugs. It is a hindrance to the attainment of perfect yoga. It is the antithesis of knowledge itself. All our sorrows are ultimately reducible to unconsciousness or ignorance.

Next as the result of *chitta-vritti-nirodha*, it is stated in the *Yoga Sūtras*, we have the centering of one's attention on oneself (and not any state of unconsciousness). It is the *avasthāna* in the *svarūpa* of the *Drashṭā*, or the Self. What such an *avasthāna* means will be clear when we understand how our individual consciousness is confined within the space of our body. To think of an object however far away from our body is not the same as being with the object. We can never leave the space of our body-organism except by dying. The confinement within the space of the body is a necessity for consciousness to function as a specific individual. Any knowledge or consciousness that we may have of external objects is what is possible only through the mediation of our body and not otherwise. Stories of our adventures outside and inde-

pendent of the body are only fictions and fables. They contradict the very foundations for the evolution of organic bodies. We become subjective *abstractions* if separated from our body-space as, for example, by death, and have to wait till we are given another body to begin again our functioning life. Hence yoga-sadhana is a possibility only in the embodied condition and not as a disembodied abstraction.

The checking of the centrifugal tendency of our attention means, therefore, not an abstract condition of unconsciousness, but that our attention should be turned to know what is working and how, within the limits of our bodily form. We and our space are to become the subject and the object in one. We thus are to obtain an intimate and direct knowledge of the mechanism of body-organism which nature has provided us with as the one means of knowing the world. The body-organism is the miniature reproduction of the external world-forces and by the principle of correspondence we shall be in a position to know the macrocosm by rightly using the microcosm. The one-ment of our body and ourselves attained by such attention given to our own body-space is the real Samadhi. Samadhi is not a state of unconsciousness or catalepsy, as ordinarily supposed, but the realised one-ness of being of ourselves as both the subject and the object at the same time. While other objects are 'others' to us, there is an intimacy between our body and ourselves which makes it possible for us to absorb the body into ourselves. Hence, the possibilities of attaining immediate and intimate knowledge of external objects, whatever they be, lie in attaining direct consciousness of our own body-space. Now, as we are, any attempt to probe deeper into our body-form and its functions is baffled, and we have only a most superficial knowledge of it. When something is wrong within the body there is only a vague warning of pain and nothing more. By yoga-sadhana this line of resistance must be overcome. The whole labour of evolution in producing the wonderful mechanism of the human body is only to help us to obtain the most intimate and direct knowledge of the world and of ourselves as true individuals through its mediation. What we now have as the sciences of biology and anatomy do not give us any such intimate knowledge. Only a yogi is capable of obtaining a *living* knowledge of himself which no external observation can ever give. Samadhi thus is the method of becoming directly conscious of oneself but not throwing oneself into unconsciousness like the hibernation of some Arctic animals or waking up in prescribed time with no better wisdom than what existed before. It is not to create wonder in others but to know

oneself that samadhi is intended. Samadhi is a positive state of consciousness, of the whole attention being entirely given to oneself; it consequently implies abstraction from the external surrounding world. But such abstraction should not be identified with its real positive nature. Samadhi is the most intense jagrat state in relation to the body-form, its structure and function and its correspondences with the external cosmos.

When such direct and intimate knowledge of one's body-space is obtained the next step consists in the actual working out of the analogies and correspondences between the microcosm and the macrocosm by which an equally direct knowledge of the external world is obtained. This process is known as *Samyama*. What *samādhi* is to the knowledge of one's own body-structure such is *samyama* with reference to any object of the external world. The yogi is thus said to have a knowledge that is certain and infallible. We thus note that the usual 'opposition' between the knower as subject and the known as object is what is transcended by the *samyama*-process of the perfected yogi when also he directly realises that one and only one Principle, however it is called, pervades the whole world, the subjective as well as the objective. It is at that level of so knowing in a higher dimension, as it were, than that of our ordinary ratiocinative and relational thinking, that the real import of the Upanishadic Mahavakyas is directly *experienced* instead of remaining merely as verbal learning. That all is Brahman and that there is none other, that both the individual consciousness as subject and the external Prakriti as object are only expressions of the same Brahman, stand not only as postulates for the yoga endeavour but also become realised facts of experience. Without a belief in such a postulate no yoga endeavour becomes possible, nor any success in attaining the goal of human evolution. Anger, hatred, fear and other animal qualities or any self-conceit or *ahankara* of the separatist type would disqualify the individual to become a yogi. Both Samadhi and Samyama would be impossible for one in whom the least element of "otherness" is present. The highest Vedantic category of the unity of all in Brahman, the unity of both the subject and the object, will not be a matter of direct experience to one who sees differences alone. *Brahma Vidya* or *Atma Vidya* means only the experience of such unity. Advaita, the philosophy of non-otherness, is not a logomachy or wrangle of words or any logical argument, but the direct experience of "Sarvam khalvidam Brahma" and "Aham Brahmasmi". To achieve such Advaitic Siddhi, one must fully have faith in and appeal to that Supreme and all-pervading spirit, Brahman, which remains the one eternal

foundation of all being. Hence the one prayer of the would-be Vedantin, "*Asato mā Sadgamaya, Tamaso mā Jyotirgamaya*" and "*Mṛtyor mā Amritam gamaya*", in all his life, in thought, word and deed. Only such an individual with Brahmic consciousness deserves the appellation Soul, or Atman, and not the fleeting forms of human shape acting under the influences of the separatist animal instincts.

In concluding this brief study of ours regarding the centripetal direction of one's consciousness, we shall note in passing what the terms *Jāgrat*, *Svapna*, *Sushupti* and *Turiya* should mean. These so-called states of consciousness might with better reason be designated as increasing stages of unconsciousness or subjectivity. *Jāgrat* is our normal wakeful condition. The word simply means wakefulness and watchfulness, and hence the consciousness of the real and objective world. Of course we know that we are now surrounded on all sides by unconsciousness. We forget our past and are ignorant of what we shall do or what will happen to us next. The normal *jāgrat* state is centrifugal, *pravṛttic* in its direction. Its ideal condition is one of full consciousness where there shall be no reason for any unconsciousness or ignorance. Only this realised Brahmi-sthithi can give the full connotation of the *jāgrat* state. It means the conquest of all forms of *Avidya*, where no delusion or illusion is possible. The other states of consciousness will then be seen as more and more partial, more subjective and less objective, and whose knowledge or objective-value is consequently also less. As we fall asleep and get into a dreamy state we notice that we seem to be drawing inwards and become less aware of our surroundings. A dream is but a variety of reverie where even the little awareness of the external world that is found in waking reveries is withdrawn, and consequently the imagery assumes a vividness like that in the wakeful condition. In the dream condition our minds also become susceptible to the influences of the general mental atmosphere, somewhat like radio-receivers, by a sort of garbled telepathy, and we consequently get jumbled incidents with no sense of discrimination or of reality correcting such impressions. The dream, thus, has no knowledge value, like what we have in the waking condition. Dreams cannot be shared by us as denoting a common world like what we have in the waking state. They are, therefore, mere subjective states, and must disappear in the yogi who has evolved the ever-wakeful state of consciousness. The third state, *sushupti*, is a still more intense form of the subjective condition, a state of suspension of conscious life. Since it is difficult to prove that one has no dreams, for nor-

mally we forget them, it cannot be shown that there is a dreamless sleep like *Sushupti*. If it really exists it may be that *sushupti* is a cosmic contrivance for complete restfulness into which we periodically enter in order to recoup physical and mental vigour for subsequent active life. But, as a knowledge-giving phenomenon, *sushupti* indicates no value that we are conscious of. The other-worldly or anti-body prejudice of the ascetic mentality is the only reason why *sushupti* is exalted over the *jāgrat* state. It is this negative attitude of other-worldliness that looks on *sushupti* as a sort of temporary union with Brahman as though the Brahmi-state were a mass of unconsciousness! Still more abstractly subjective is what is called the *Turiya* or the fourth state of consciousness. It is either real death or the death-like state of the popular form of *samādhi*, so much so that when a reputed saint really dies he is considered to be in a state of perpetual *samādhi* and is buried as such. As we have already stated, the goal of human evolution is towards perfect *Vyaktahood* or complete expression of all that is implied in the cosmic Ideation or the Archetypal Man, and not a reversion back into the original *Avyakta* or ideal condition. That "original Idea" has itself become the world like a seed becoming the tree, and no longer exists as such for any one to re-enter. We, Humanity, are the flowers and fruit of the great cosmic tree whose seed and roots are above in the plane of cosmic Ideation.

Thus we have seen in these two discourses how we are to understand ourselves as individuals in progress through evolution to become real and free souls. Such is the 'metaphysics' behind the History of Humanity. This evolution is a two-fold process. One is what moves outwards representing the centrifugal direction or *Pravṛtti* by which knowledge of the outer world is gained and the individual understands himself by his actions as only a *medium* of the great cosmic will. The other is its necessary complementary, viz., the tendency to remain eternally linked up in his consciousness to the Origin by the centripetal direction or *Nivṛtti* without which no one can be a soul. These two paths should never be alienated from each other if man is to fulfil his destiny to evolve into a perfect soul. To take them as antagonistic to each other would lead us only to an irreconcilable dualism from which no escape is possible by any metaphysical somersault. Only to such an individual who knows their unity will it be a matter of direct experience that Godhead has Its centre everywhere and circumference nowhere, i.e., in the Upanishadic language, he sees Brahman in all and all in Brahman, as the culmination of knowledge or *jñāna*, the Great *Brahma Vidya*. Thus shall we also understand

the great Upanishadic refrain, "*Pūrṇam adaḥ, pūrṇam idam, Pūrṇāt pūrṇam udacyate; Pūrṇasya pūrṇam ādāya, Pūrṇa-meva avatishṭhate*", Whole is That (macrocosm) and whole is this (the microcosm), this whole being derived from That whole, that Whole (ness) alone eternally remains—(this whole being but Its reflection).



THE CONFLICTING POLITICAL PHILOSOPHIES OF OUR AGE

By ·

P. NAGARAJA RAO

Our age has seen the rise of three distinct political systems, and the gradual retreat of Democracy before the advancing tide of the new political systems. Fascism in Italy, Nazism in Germany, and *Stalinism* in Russia are both new and powerful. Democracy even in its traditional home, Great Britain, has been for some time under a cloud.

The major problems of our time are problems of economics. The older political systems have so far been unable to exhibit either courage or competence in the handling of economic problems. The new political systems concern themselves primarily with the economic problems and have successfully mobilised economic discontent in their respective countries, for the purpose of political aggrandisement. The solutions offered by the new political systems may or may not answer the primary needs of our time, but it cannot be denied that they have actively taken up their solution. In the following pages an attempt is made to present in brief compass the philosophy underlying the various approaches made by the different schools of thought to the problems of our time.

I

Fascism

Fascism is one of the important schools of contemporary political philosophy. It has a distinct and clear view of its goal. The philosophy of Fascism has been translated into dreadful and violent political realities in Germany and Italy by Hitler and Mussolini. Fascism is a philosophy of action. It is primarily a reaction against the intellectual Rationalism of the 18th century. Eighteenth century thought proclaimed to the world the efficacy of reason in social life and implied a belief in a natural religion, natural morality, natural law and the rights of man. It held that all these facts could be demonstrated to be legitimate and inevitable inferences from self-evident axioms after the manner of Euclid. The 18th century philosophy further believed that progress was automatic and inevitable. The perfectibility and the educability of man

through the use of reason was almost an axiom with them. This grand temple of reason was blown up sky high by the Fascist view of man. The anti-rationalism of Fascism was the result of a number of causes.

Fascism does not believe in the superior potency or morality of persuasion or reason over force. It has no great use for rational arguments. It believes in mystical intuition and not in induction and observation. They seek the good "in the will of man and not in feelings nor in cognitions, they value power more than happiness, they prefer propaganda to scientific impartiality. They substitute glory for pleasure and pragmatic assertion for knowledge."

Fascism repudiates pacifism as a creed born of cowardice. They deny the demand for the justification of power in terms of other ends than power. They hold that action comes first and thought afterwards. They hold that power is its own justification. This doctrine of the fascist is a repudiation of all that is fundamental to political thought. The idea of the justification of power in terms of the benefit the exercise of power has conferred on us, be it the good life, the highest standard of living, the greatest good of the greatest number etc.,—is ridiculed by the Fascists.

The Fascist-Nazi view of man is entirely different from that of the Rationalist. To the Fascist-Nazi, the individual is of no concern at all. His aim is not the common man in the street or his interest. He wants to produce the superman who should guide mankind. The production of the superhuman Duce or Fuehrer is the aim of the race and the object of civilisation. Nietzsche, the great anticipator or the spiritual father of fascist philosophy, states that mankind is much more of a means than an end, and that mankind is merely experimental material. The end he proposes is the superman who by the annihilation of millions of the botched and bungled vindicates the glory of the state. Carlyle throws a revealing light on the fascist mind when he says, "the purpose of humanity is the noble man and others must yield to him. We need, not elected parliaments, but Hero kings and a whole world not unheroic. True liberty of man consists in his finding out or being forced to find out the right path and to walk thereon. Democracy is a cry of despair that you cannot find any heroes to govern you."

Various interpretations of Fascism are put forward.¹ The foremost interpretation is that the people of Germany and Italy, tired

1. See the chapter on the *Theory of Fascism*, pp. 605-663, in Prof. Joad's *Guide to the Philosophy of Morals and Politics*.

of the slow and inefficient working of parliamentary democracy voted for the principle of leadership which gave them security and satisfaction.

Fascism is treated by others as an emotional outlet for a certain section of men i.e. the vigorous middle class in a modern democracy. These middle class men found life extremely boring and mechanical because, they had to live in common with thousands of others and they found no outlet for their untapped powers and unsatisfied impulses. They could not join with the working class because of their snobbery and tradition. So they found an opportunity for exploiting the masses in league with the supermen of the age. These supermen according to the communist analysis in league with certain capitalist armament manufacturers and others employ the socialist tactics and come to power and function in the interest, not of the whole nation, but of the group that assisted them to power. Fascism is armed capitalism fighting its last battle according to Karl Marx. It is the last stage in the inevitable breakdown of capitalism. The Marxians explain the facts in terms of economics. Capitalism when it was in its expansionist phase was able to grant concessions to its workers. The workers by the aid of the political liberty given to them organised themselves to a great extent and obtained the maximum concessions. At this point the capitalists found themselves in a fix. The expansionist phase of capitalism having stopped owing to the lack of new markets they could not give any further concessions. The alternatives before them were self-annihilation through the extension of concessions or the denial of liberty to the have-nots. They chose the latter and thus political liberty was suppressed. Fascism is the contracting phase of a declining capitalism. This in short is the Marxian analysis.²

Some view Fascism as a new awakening of the human spirit and speak of it as if it were a Renaissance of human values. They interpret it as the victory of the Roman over the Greek spirit. Europe, according to this view, was dominated by the Greek spirit, for some time. The Greek spirit stood for speculation, Rationalism, and individualism. The Romans stood for loyalty, solidarity and discipline. "The Greek spirit unchecked ran to excess, an excess which was anarchy in politics, chaos in morals, and loss of faith in religion." Fascism stands for a firm return to the Roman virtues of loyalty, discipline, and service, on this view.

2. See the new introduction to Prof. Laski's *Liberty in the Modern State* (Pelican edition), pp. 18-20.

Yet another interpretation of Fascism points out that it is a substitute for religion. The advance of scientific materialism and the corruption of the churches have undermined the faith of the average individual in religion. The suppression of the faith in the divine gave rise to surprising outlets. The human need to believe can never be eradicated. Man cannot put up with a spiritual vacuum. Canon F. R. Barry in his book on *What has Christianity to say?* points out that "before all else man is a worshipper. From his earliest appearance in history he has been building pathetic altars, stretching forth his hands to the unknown God. This is persistent through all the mazes of his social and religious record, through all its perversions and unlovely forms, its ignorance, its cruelty and terror—man's ineradicable quest for God in whom alone he can find rest and fulfilment. If he cannot find God in heaven, he must fall down before a God on earth." That God on earth turns out to be Hitler or Mussolini.

A deep psychological analysis of the phenomena of Fascism gives us a more dreadful picture of it than what the ordinary student of political science reads. Fascism is essentially a revolution against the *Economic concept of men*. The breakdown of democracy as well as of Socialism was due to the acceptance of the false assumption that masses of men, especially when they are conscious of their grouping in classes will, on the whole, over any considerable period of time, tend to act in accordance with their economic interest and more especially their class interest. The partial success of the Nazi movement is a patent defiance of this assumption. The interpretation that Fascism is a malignant outbreak of primitive violence and brutality does not state the specifically individual characteristic of Fascism. Violence and brutality are common to all revolutions and all that they indicate about Fascism is that it is revolution and nothing more.

The Marxian interpretation of Fascism is stated in great detail, as the final one by many of our socialist economists. Cole, Laski, Strachey etc., have all given their assent to the Marxist version of Fascism. Such an interpretation is not true to facts. A scathing criticism of the Marxian version together with the psychological interpretation of Fascism is attempted with no little success by Peter Drucker in his book on the *End of the Economic man*. The value of the volume is considerably enhanced by the brilliant introduction of H. N. Brailsford expressing his assent and appreciation of Drucker's thesis. Fascism pursues contradictory ideals. It has subordinated big business and also small property owners. It is anti-capitalist as well as anti-socialist.

Fascism is essentially a revolution. It implies a change in the order of values, especially man's conception of his own nature and of his place in the universe and society. Fascism is the result of the collapse of European spiritual order. Capitalism as well as socialism failed because both based their civilisation on the assumption of the primacy of the *Economic man*. Capitalism was a social creed which held that profit motive was the means by which the ideal free and equal society would be automatically established. So capitalism subordinated all activities to the economic motive. The initial false assumption of the capitalist about the primacy of the economic factor, stood in the way of the realisation of the free and equal society for which capitalism stood. It is the stress of the primacy of the economic factor over all other factors of life that is standing in the way of the acceptance of Marxism.

Fascism succeeds in part because it has a non-economic view of society. It is simultaneously hostile to the capitalist assumption of the supremacy of the private profit motive and to socialism. Though this looks muddle-headed, the fascists offer a measure of social equality in common, subordinate to the state as a compensator for economic inequality. Thus the social standing of the individual is made the determinant of his actual economic status. The ideal of the Heroic man is glorified, his preparedness to sacrifice, his self-discipline, his self-abnegation are all said to be independent of his economic status. The Fascists supply to all the classes an equality in social fundamentals, sufficient to compensate them for their inevitable rigid economic inequality. Profit is not made much of in Fascist economics. Instead of abolishing it, the government lets the profit circulate once more through the economic system only to regain it in the form of taxes and compulsory loans. "It is a stage after communisms and capitalisms have proved illusions." The moment there is the organisation of society on the basis of the subordination of the economic motive to the social self, society would be stable and not torn by internal war.

None of the estimates of facism above described would appear to afford an exhaustive explanation of the seemingly tremendous vitality of the fascist systems now in power in Europe. One of the fascist systems in Europe, which was and is still in an exceptionally vulnerable and exposed state, has defeated and survived the only serious sanctions of the effort of the first serious experiment, in international government. That the protagonists of the sanctions were half-hearted, insufficiently zealous and conscience-stricken may be true. But that does not explain their sneaking sympathy

with Fascism's daredevil attempt to found an empire in Africa. Perhaps "Fascism" is not confined, as one would suppose, to the so-called dictatorial countries. There are indeed many democratic publicists whose devotion to the common weal and unselfish idealism are above suspicion who have found much to admire in some of the achievements of Fascism, however much they might deplore or detest its methods. Few would be found, among those who still keep their judgment free and their minds receptive, to condemn Fascism wholesale. Wholesale condemnation of Fascist theory is one thing; condemnation of its methods, another; eighty million Germans and thirty million Italians whose enthusiastic allegiance the dictators count on so confidently cannot be condemned as sub-human degenerates. If, alternatively, it is suggested that Fascist propaganda and technique of regimentation are so powerful as to reduce these vassal masses of more or less normal human beings into mere automata, the argument is insincere and unconvincing.

II.

Communism

Communism has unlike some other systems of political thought a well-articulated metaphysics of its own. Karl Marx and Frederick Engels are the official exponents of this cult. It is a definite reaction against the existing economic structure of society i.e. Capitalism. The economics of communism is the logical outcome of the metaphysics of Karl Marx. The Philosophy of Karl Marx is known as *Dialectical Materialism*. This doctrine was further expounded and developed by Lenin and Bukharin. This doctrine has already transformed (though not very adequately) the social and political institutions of a fifth of the inhabitants of this planet. Other enthusiasts of this cult live in the hope of producing similar changes in the other four-fifths of the planet. The philosophy of Marx has for its metaphysical fountain-head Hegel, the great German thinker.

Hegel represented the development of thoughts as well as the things of the world as a progressive dialectic movement through conflict and synthesis. The thesis is said to produce antithesis, and the transcendence of the thesis as well as the antithesis leads to the synthesis. Hegel represented History as a progressive realisation of the spirit through the process of the dialectic. It was also taken for granted that the process was inevitable and that every synthesis in the dialectic process was a step forward. Marx's *Dialectical Materialism* is very different from Hegelianism as well as

the scientific materialism. Marx turned right side up the dialectic of Hegel and ascribed the priority and initiative to matter and not to mind. To Marx neither reality nor the individual was static. They were dynamic. In the very process of knowing, we change the object we know. The mind is not a searchlight that illumines the objects it knows. It on the other hand changes the object. According to Marx's theory of knowledge "to know a thing is to alter it." There is no passivity for the objects known or for the knower. He abandoned the static view of reality and borrowed the dialectic view of reality from Hegel. Hence the materialism of Marx is styled as dialectic. Let us examine a little more closely his "Materialism". Matter is not static, according to Marx. It is dynamic. Marx does not admit the independent existence of mind as a separate entity different from matter. The motive force of the whole process of history is matter for Marx. Ideas or thoughts can exist according to Marx only in the minds of individuals. They are the expressions of the environment in which they live. "The ideal is nothing other than the material world reflected by the human mind and translated into terms of thought." Marx's predictions about the contradictions and of the final collapse of capitalism are all based on his view of dialectics. His concept of the activity involved in knowing an object is responsible for his verdict on philosophers "that they have merely interpreted Reality and not changed it." Marx stressed the primacy of the economic factor. The economic factor is said to be the most effective determinant of all the other aspects of human life.

From his dialectic materialism he proceeds to his materialist interpretation of history. Engels, the friend of Marx, has given an account of the materialist interpretation of history in his book *Anti-Dühring*. "The materialist conception of history starts from the proposition that the production of the means to support human life and next to production, the exchange of things produced, is the basis of all social structure; that in every society that has appeared in history, the manner in which wealth is distributed and society divided into classes or orders, is dependent upon what is produced, how it is produced, and how the products are exchanged. From this point of view the final causes of all social changes and political revolutions are to be sought not in man's brain, not in man's better insight into eternal truth and justice, but in the changes in the modes of production and exchange. They are to be sought not in the philosophy but in the economics of each particular epoch".

This spirit has afflicted all the other aspects of life. The cultural, social, legal, ethical and aesthetic institutions of any age are

said to be the by-products of its fundamental economic structure. So the communist describes the law and morality of our age as capitalistic and even our democracy is styled as capitalistic. Our literature is styled as bourgeois; hence it is declared to be bad.

Marxian communism hopes to see the end of capitalism through the sheer inevitable force of the dialectic, on account of the inherent contradictions. Feudalism gave place to capitalism and capitalism in its own turn would give way before socialism. Marx's theory of value states that the value of any commodity is to be measured by the quantity of labour which goes to its production. This doctrine together with his principle of the concentration of capital brings about the two definite classes, the haves, and have-nots, the Bourgeoisie and the Proletariat. The greater the degree of the concentration of capital, the greater is the intensification of the process. The increased complexity and concentration of capitalism in a few hands produces a class of dependents. Side by side with the centralisation of capitalism there is the increase in the proletariat. The workers come to a point when they can no longer endure the misery that is involved in the capitalist order run by rickety institutions with class-bound statesmen at their top. They find at this stage that nothing short of violence can bring about the liquidation of the capitalists. "Violence" Marx said "is the mid-wife of a new social order." At this stage the economic drive as well as the inevitability of the dialectic process brings about the unity of the "workers of the world" and thus the communist party comes into existence. A strict military discipline is prescribed for the party and a totalitarian outlook is generated in them. Lenin once said "that all the literature in Russia should be party literature" and that a school apart from politics, is a lie and a hypocrisy. The communist party with the use of organised violence is likely to bring about the death-knell of capitalism and then the expropriators are expropriated. Thus capitalism in the words of Marx produces its own grave-digger. The state automatically withers away. And the new era of socialist democracy is said to take the place of the dictatorship of the proletariat. The dictatorship of the proletariat is said to last for some time to prevent counter revolutions.

The Marxian view of man is not the entire truth. The economic factor is only one of the aspects that determines man's outlook and action. There are a number of other factors governing the actions of men. Human history in the words of Prof. Joad hangs on a thousand cross-currents that deflect the stream; a

thousand side winds blow athwart the course of history; personal intrigues, sexual jealousy and desire, love of power, thwarted ambition, slighted vanities and injured pride, religious enthusiasms, reforming zeal, party strife, even the disinterested desire for the public good, all these on occasions play a part in determining events. The Marxian view of history fails to take note of the complexity of the forces that govern the flow of history. It is a gross exaggeration to give the palm to the economic factor in preference to all others. There are many other factors than the economic governing the activities of men. "Xerxes had no lack of food or raiment or wives at the time when he embarked upon the Athenian expedition. Newton was certain of material comfort from the moment when he became a Fellow of the Trinity College, but it was after this that he wrote the *Principia*. St. Francis and Ignatius Loyola had no need to found orders to escape from want."

To believe that individuals alone govern the movements of history is also not absolutely certain. There are no patterns in history one succeeding another in alternation or in a cyclical manner. The dialectic and its movements are claimed to be automatic. The Marxian view of progress, that it is inevitable and automatic is not scientific. Some sincere historians have expressed the view that they have failed to perceive a single well-determined pattern in history. H. A. L. Fisher in his preface to the History of Europe says that "one intellectual excitement has, however, been denied me. Men wiser and more learned than I have discerned in history a plot, a rhythm, a predetermined pattern. These harmonies are concealed from me." So the Marxian view of man is too simple to be true. Human affairs are not so cut and dried like a binominal theorem. Human nature is not definite. "Human nature is heaven-high and hell-deep." Human history hangs upon a thousand factors, and if one of them had been different, history would be otherwise. Trifles seem to govern the movements of history. Bertrand Russell has a passage in his book on *Freedom and Organisation* illustrating the view. "Admitting that the great forces are generated by economic causes, it often depends" says Russell, "upon quite trivial and fortuitous events which of the great forces gets a victory. In reading Trotsky's account of the Russian Revolution, it is difficult to believe that Lenin made no difference, but it was touch and go whether the German government would allow him to get to Russia. If the minister concerned had been suffering from dyspepsia on a certain morning, he might have said 'no' when in fact he said 'yes', and I do not

think it can be rationally maintained that without Lenin the Russian Revolution would have achieved what it did. To take another instance: if the Prussians had happened to have a good general at the battle of Valmy, they might have wiped out the French revolution."

To take even a more fantastic example it may be maintained quite plausibly that if Henry VIII had not fallen in love with Anne Boleyn the United States would not now exist. For it was owing to this event that England broke with Papacy and therefore did not acknowledge the Pope's gift of the Americas to Spain and Portugal. Speculations like this are possible. The Marxian view of history and dialectics is not demonstrably true.

The Marxian contention that class consciousness should be eradicated as a prerequisite for the establishment of a just order of society goes against the facts of history. After the Proletarian revolution the working class comes out at the top. As long as the Proletariat lasts, there is bound to be a class division of some kind or other. The communists assure us that after the dictatorship of the Proletariat there would be the establishment of the communist order of society. They say that in the long run the dictatorship of the proletariat would go. One is tempted to repeat the question of Prof. Laski "How long is the run to be?"

The Socialist method of establishing the new social order through the use of violence raises the larger question of ends and means. To the communist the means are the ends. But the use of violence more often perpetuates the old order and does not prove to be the midwife of a new social order. What is gained by violence can only be maintained by violence. Hence the ethical objection to the communist creed. The central spirit animating the Marxian ideology is that of rationalistic humanism. To the Marxian there is nothing mysterious in this universe and man can be changed into whatever shape we will by the reshaping of the environment. It is a determinist view of history very difficult to accept as the entire truth.

There is no denying the fact that Marx was the founder of scientific socialism in the strict sense of the term. His doctrines need a great deal of emendation in various aspects. His significant contribution is his law of concentration of capital and the subsequent passing of the control of economic life from free competition to monopoly. His doctrine that there is the economic motivation in politics is undoubtedly largely valid. It was a daring assertion in

his time to have stressed the necessity of the acquisition by the state of all the means of production, with the consequence that socialism must, from its inception embrace a whole nation if not the whole world. But if Marx be not treated as an infallible religious Prophet with a dogmatic creed but a secular thinker his doctrine will still be found to contain much important truth, neglect of which certainly is unwise and may be disastrous. There are many indications in the world to-day of a growing recognition of the inadequacy of the purely materialist interpretation of history and of life. It may be suggested that what is called the materialist interpretation of history states the bare truth and does not affirm the moral rightness or desirability of the continued dominance of the economic factor in history. But the arbitrary operation of the economic factor will necessarily produce an equilibrium unfavourable to the emergence of the true spiritual values of life. It is not merely with the question of the sharing of the goods of this life that the Marxian is ultimately concerned. The Marxian insistence on the state ownership of resources tends merely to prevent or at any rate neutralise the arbitrary working of economic power. The application of modern power to the process of production has totally disorganised society. The modern conditions may well be described as a reign of anarchy. The Marxian fear that ere long this reign of anarchy would become a reign of terror 'involving untold cruelty and misery' cannot be said to be wholly unfounded. The ideal of a classless society with machines doing the work now done by men and creating a vast amount of leisure for the pursuit of the more durable values of life is not in itself a utopian notion. The trend of modern developments points that way.

III

Democracy

The theory of Democracy is not a definite system of political philosophy like Communism and Fascism. It is a collection of principles that are generally regarded and accepted as intrinsically valid. They are not demonstrably true in the laboratory sense of the term. They are accepted by the Democrat as self-evident. The accepted principles of Democracy are not related to each other by any obvious logical connection. The assumptions of Democracy are not verifiable nor can they be established by any force of syllogistic logic. For positing the first principles of Democracy the only authority is intuitive apprehension. It does not mean that every body would assent to them or assert them. If any one were to

question the validity of the Democratic principles, we have no method by which we can prove the principles to the satisfaction of the questioner.

What are the democratic principles? They are, first, that the individual is of the greatest value in life and that the success of any civilisation or the efficiency of any government should be measured in terms of the scope for individual development. The production of "the splendid individual and not the mechanically efficient society" is the aim of the Democrat. To a very large extent a Democrat is an individualist. The stress is on the growth of the individual and not on the community. The individual for the Democrat is not to be treated as a drop of blood in a racial purity, nor as a cog in a proletarian or totalitarian machine, nor as an ant in a social termitary", but as a self that must live and grow according to the highest law of its being. Politics are secondary to it. The sacredness of the individual is of greater import to the Hindu democrat than to the Rationalist. To the rationalist there is nothing beyond the grave for the individual. The Hindu democrat believes in the spiritual and indestructible nature of the individual; hence his greater attachment to Democracy. Democracy to the Hindu is no secular creed as it is to the rationalist west. The belief in the sacredness of the individual is the cardinal tenet of democracy. To express it concretely the poorest he or she has a life to live as the richest he or she. The poorest he has his own life, and is not to be managed and drilled by others for the achievement of their ends. The individual's life is his, and he has to live it. So he must give first his consent to be governed at all and then must put himself under the government he likes. Nothing can ever compensate an individual or a people for their slavery. The individual is the thing that matters. "The really valuable things in human life are individuals, and not the things that happen on a battlefield or in the clash of politics or in the regimented march of masses of men towards an externally conceived goal. The organised life of the community is necessary, but it is necessary, as a mechanism, as a framework, not as something to be valued on its own account".³

The second important principle of Democracy is the belief in the principle of Freedom as fostering the tender plant of individuality. Freedom is the life breath of the individual. Liberty is

like health and air. We know its value only when we are denied liberty. Freedom is the thing for which the individual lives and without it he is no better than a robot or an automaton. The denial of freedom is the denial of all that makes life worth living. A systematic denial of freedom reduces men to the level of brutes. They are not shrubs to be cut into the shape of peacocks by a skilled gardener. The shrub remains passive whereas the human being can convey his ideas to others. The denial of freedom produces in men listlessness and cruelty together or in alternation. Passive adaptation is impossible for the individual; so the individuals where freedom is denied to them turn out to be grotesque and distorted specimens. In the long run their powers of endurance are also at an end. Endurance is the outcome of freedom. Without liberty an individual will not be able to learn to endure. Thus the denial of liberty would stand in the way of the achievement of true strength, which is valuable and real only where it is self-developed.

From these twin concepts of the sacredness of the individual and necessity of freedom all other minor tenets of Democracy follow. The Democrat has no faith in the cult of the *Super-man*. He refuses to be guided by the intuitions or the genius of any one man. The Democrat would never consent to sacrifice the manifold personalities of the different individuals for the production of the most powerful or imposing Leviathan. He does not subscribe to the principle of infallible leadership, however great the leader may be. He is out to do away with the Philosopher-kings of Plato. He disbelieves in the principle that the few must guide and the rest must follow. The Democrat believes all men reach their best in different ways. In the words of Mill the democrat wants to produce individual vigour and manifold diversity. The moment we discredit the principle of leadership together with the cult of the super-man, we grow to believe in the capacities of the ordinary man. The ordinary man is neither wicked at heart, nor weak in head, he is not even malleable clay to be shaped into form. The Democrat believes that the individual in a free environment has the greater chance of rising to the full height of his stature.

In the words of Lowes Dickinson "What we should aspire to create is not men like statues, beautifully shaped for some one else to contemplate, but living creatures choosing good because they know evil." So he is against all regimentation of the mind.

What is the function of the state in a Democratic world-order? Should it use violence and if so to what end and how far? The

3. Russell's *Power. A New Social Analysis*, p. 316.

state according to the Democrat is for the man and not man for the state. The state should make the individual's good life possible. Its primary purpose is to maintain law and order, though its plenary purpose is to assist and enable the individual to achieve the good life. The state should be concerned with the back-ground functions rather than fore-ground activities. It should not prescribe men's activities, but must be prepared to step in and check the evils that are likely to result from the economic, ethical and social activities of certain men. The anti-social results of the activities of some men have to be checked by the state. So a certain minimum of force is necessary for checking such activities. This in short is the function and justification of a state. Liberty along with Democracy would perish if their upholders are too high-minded even to raise their hand in defence of those principles. Force without justice is not more of a disaster than justice without force. If dictatorships are the example of the first, democracies should not exemplify the second. Democracy cannot do away with the state as such.

The Democrat is against power politics. He believes with Lord Acton that power corrupts and that absolute power corrupts absolutely. Power expresses itself in a number of ways. A study of the human civilisation in terms of the function of power is attempted by Bertrand Russell, a studied answer to Marx. The theory of Democracy believes that power must be submitted to checks and that it must be revised and be capable of being withdrawn. Power must be tamed by educating the democracy. It is only a democratically tempered man that can successfully keep power in check. "Constitutions," observes Plato, "are not born out of rocks but out of the dispositions of men." A Democracy without freedom and democratically tempered men is impossible. The Democrat insists on discussion as fundamental to his creed. Its purpose is to discover and represent the differences. Toleration should be a moral principle native to Democracy.

The Democratic temper of mind is achieved by a scientific type of education. The use of persuasion and reason in preference to force and belief in the assured success of reason are fundamental to it. The reason of the Democrat makes him confine the use of violence to a minimum. The Democrat substitutes impartiality for propaganda. The Democratic temper wants to foster freedom of speech, freedom of association and freedom of action. All the various schools of Democracy are agreed that freedom i.e., political liberty, is the cardinal principle of Democracy. The democratic ideal with its banner of political liberty was considered in the

post-War days as the greatest ideal of politics. The Democratic theory was translated into not very adequate institutions. No institution however elaborately framed can express the true Democratic ideal. The institutions through which Democracy expressed itself in Athens were of the direct type. But there was a huge colony of slaves negating the principles of Democracy. In our modern world the theory of Democracy has expressed itself in the various forms of representative institutions. The Parliamentary institution and the scheme of universal suffrage have come to stay as more or less genuine if not perfect expressions of the Democratic theory. Democracy is a social philosophy that argues that well-being is best attained by giving the individual the largest possible initiative in action. The institutions are framed with this end in view.

The great use to which political liberty was put in the past could not easily be overestimated. The secular state with Democracy as its creed expressing itself in the free grant of franchise was admired for a time. Since the advent of Marxian socialism, people have grown discontented with the content of political liberty and its use. Liberty was considered as a Liberal fetish and as a mere academic good. The cry of the day is that in capitalist world order, i.e., in an unequal economic context, political liberty is just twaddle, "sound and fury signifying nothing." It is a poor consolation, says, Shaw, to endow an individual with the franchise when he has an empty stomach. Political liberty devoid of economic equality is considered to be an opiate administered by capitalist economists. For the first time Prof. Laski qualified the Democracy under which we live and called it *capitalist Democracy* where we have dull political liberty entrenched in an unequal society. A true Democracy as distinguished from Capitalist Democracy should create an equality of opportunity and must try its best to indefinitely diminish if not to totally abolish the economic inequalities which strongly militate against the effective use of political liberty. The great task of a Democracy to-day is to redefine the class relationship and disentangle political power from it. In a capitalist Democracy it is assumed "that when once freedom is granted everything follows"; give liberty to all, everything retakes its proper place and everything is at peace. The main function of justice in a Capitalist Democracy is the protection of property. Capitalist Democracy worked admirably so long as the environment was stable enough to maintain the self-confidence of its governing class. But inherent in it was a new struggle for power. By the use of political liberty Labour

got concessions up to a time. By the time the era of capitalist expansion came to a close owing to several economic factors such as the contraction of markets, the capitalist class could not yield any more concession to labour. The moment labour pressed in to gain more and more economic concessions with the help of the political liberty they enjoyed, the capitalist had to cry halt. Any more co-operation with labour would mean the extinction of their profit. So they took to the suppression of political liberty. This has been called the Fascist phase of capitalism i.e. armed capitalism. The Marxians hold that genuine liberty is not merely political. It must imply economic equality also. Liberty and equality are not antithetic terms. "Liberty only begins to operate significantly upon the plane of equality," and without it, as Hobhouse put it, "it is a name of noble sound and squalid results." "Equality supplies the basis out of which liberty comes to have a positive meaning."

The Socialists, therefore, hold that what we want is the necessary economic justice as the back-ground for liberty. So they decry political liberty as not worth having without economic justice. Democracy might find its fulfilment in socialism, but the doctrine of political liberty in a capitalist state is not as useless as the Marxians imagine it. It is by the effective use of political liberty that men have been able to achieve many a social reform such as old age pension, unemployment and health insurance benefits, free education, etc. The history of legislation even in Capitalist Democracies shows that political liberty is not an impediment to economic liberty. On the other hand it forms itself an ally of it. Democratic liberalism far from being a foe of socialism is its ally. What is socialism, but the extension of the democratic principle into the economic sphere? The students of Politics with definite leanings to the left have expressed their despair as to the possibility of ushering in socialism through constitutional means. Prof. Laski in his recent book on *Parliamentary Government* has pointed out that the so-called democratic institution of parliament successfully functioned in the nineteenth century because it rested on a community of interests among those who, in practice, controlled its operations. Throughout that century the government of the two parties, Conservatives and Liberals, could get on very well because of the fact that both sides were fundamentally in agreement. Their quarrels were merely sham family quarrels. The end of the nineteenth century saw the rise of a political party that did not agree with other parties in their adherence to the principle of private profit and property. So the issues that were

faced in the parliament since the rise of this party were no longer mimic battles, but real wars. If the socialists were returned to power at an election and if they tried to put their programme into practice there would be no sympathy from other parties, because there is no agreement on fundamentals. The parties in opposition very well know that a socialist order would endanger the capitalists. Under such circumstances the party of the capitalists will make use of all their key positions such as the king, the church, the judiciary, the police, the civil service, the press and the B.B.C. which are under their control and thus they would destroy the legislation as well as the constitution. Hence the Socialist pleads that with the mere use of the legislative mechanism and political liberty we cannot achieve socialism. He concludes that Democracy to be real must be socialist. No true Democrat ever claims that Democracy is a final form of government. It is the least objectionable form of government that is practicable. In the long run the Democratic principle makes for civilisation. It is not a mere form of government, it is an ideal philosophy of values. It is the secret of social peace. It is not mere counting of heads nor is it cutting them, but it is the art of laying them together.

And above all, what principle of government, other than Democracy, is there which is at once a governmental principle as well as a great educator of men? If human beings form one vast family, it is through the principle of Democracy that we may teach them, educate them to love one another, to pursue in their common interests the highest good of which mankind is capable. Call it enlightened self-interest if you like,—but remember, it is enlightened—and therefore intensely human and not unworthy of men.

THE FINANCIAL ASPECT OF THE WAR

By

DR. P. S. LOKANATHAN

The old and admirable qualities of abstinence, frugality and economy which were condemned not long ago during the depression period as of doubtful virtue are once again restored in their pristine glory on account of the war. Private economy is insisted upon sternly because there is limitless public expenditure on account of the war, which can absorb every unit of capital and labour into its bottomless pit. The patriot is now the saver and the miser, while only half a dozen years ago it was the spendthrift.

Why is this? The answer is to be found in the financial and economic aspects of the war. It has been truly observed that modern wars are fought less on battlefields than in the workshops producing munitions of all kinds and essential raw materials and foodstuffs. The impregnable Maginot Line is matched by the impenetrable Siegfried Line, and provided the war lasts some two or three years success would depend more on differences in financial and economic strength than on differences of military technique and strategy. From this point of view the Allies are undoubtedly in a stronger position than Germany. The war expenditure of Great Britain has been estimated for this year to be about £2,000 millions and in the coming years it may be anywhere between £2500 and £3000 millions a year or about £7 or 8 millions a day. How is this vast, almost astronomical, figure to be secured? A nation that staggers under the weight of a peace-time budget of about £500 millions somehow manages or ought to raise revenues four or five times the normal budget. It is, of course, clear that this expenditure of £2,500 millions represents the value of all the real things absorbed in the war—the production of aircraft, guns, shells, etc., the services of those engaged in the army, navy and air force, the services of shipping and other transport agencies and of all other work involved in conducting a war—and it is therefore these real things, the materials and services, which Government actually want and for getting which they want the money.

Governments like individuals have only three ways of meeting their expenditure: from their current income; from their capital;

and from borrowing from others. There is a clear limit to the extent to which belligerent nations can borrow from abroad, because barring the U.S.A. there is no country which has a surplus to lend, and unless the U.S.A. enters the war it is unlikely she will lend even to Britain or France. Hence income and capital which constitute a nation's wealth are the resources available for financing the war. However large a nation's capital may be, a community lives only to a small extent on accumulation of capital wealth from the past. It is its annual wealth in the form of goods and services produced within the year that is the more relevant factor, because it not only constitutes $\frac{1}{5}$ or $\frac{1}{6}$ of the capital of a country but is the source from which Government can easily draw its funds. In parenthesis it may be stated that this is the reason why countries can recover so fast after a war, provided their capital equipment has not been allowed to be destroyed. The capital that is invested in buildings and plant is an essential condition for production, and unless the title to it is sold abroad, in which case it would be like borrowing abroad, it offers in itself no means of meeting the enormous war expenditure. By allowing fixed capital and plant to run down, by not renewing it and by making no provision for wear and tear or for depreciation, a country can certainly draw considerable sums for its war purposes. But by so doing it permanently injures its productive capacity, and even from the immediate point of view it is risky to do so, because the production of essential materials and foodstuffs is not less essential in war time than in peace time.

The annual income of the people of a country is therefore the fund from which it should derive all the resources it requires for the war. The amount available for Government will depend upon the margin left after meeting the needs of the consuming population. But the margin is by no means a fixed one. It is here that there is a great difference between war and peace conditions. There is no absolute limit to the power of a well-organised state to cut down the consumption of its citizens. The taxable capacity of a nation at war is far higher and governed by quite different considerations than when at peace. In war the only relevant question is, what is the lowest fraction of the annual supply of goods and services that will suffice to meet the minimum demands of consumption? Only that fraction would be left to the individual citizens of the nation. All the rest, say 40 or 50%, would by some means or other, by taxation, by borrowing or, if inevitable, by inflation, which is covert taxation, be gathered into the exchequer to meet the cost of the war. All rules, conventional or theoretical,

limiting the portion of the national income which in peace time the State can take into its coffers by way of taxation will go by the board during the war. Great Britain's larger annual income than Germany's is undoubtedly a factor of great importance in assessing their relative financial strength. The annual per capita income of Germany is about £60 to £65 whereas that of Great Britain is about £110 to £120. Even making all allowances for the higher standard of living to which the British people have been accustomed, there is a far bigger margin available to the government in Great Britain than in Germany. The annual income of the people of Great Britain is estimated to be about £6000 millions in 1938, and the war paradoxically enough is likely to increase the income still further. Although by diverting millions of people from normal peace avocations to the fighting line, the nation loses the services of those men who were productively employed, large numbers of men who were formerly unemployed are now re-employed and add to the national income. The nation now works longer hours and puts forth extra efforts and uses more intensively existing resources thereby adding to national production. Dilution of workers in skilled trades and relaxation of the various restrictions which formerly hampered productive output are other factors favouring increased production. It is true that war also dislocates industry and causes a little unemployment. The closing of the cinemas and theatres, of the issue houses and financial institutions and of enemy firms and the restriction of activities in all luxury trades and unessential industries will undoubtedly reduce income. But war makes a big demand on the labour and capital of a nation and is sure to absorb all the men temporarily thrown out of employment.

Thus the financial problem in Great Britain is how to gather up for the treasury the £2500 millions which is required for the war out of an annual income of £6000 and odd millions. The means open are, of course, taxation and loans; but these are only methods of collecting resources. The resources themselves can only come about by restriction of consumption on the part of the public. Taxation and loans are only alternative means of effecting such degree of restriction of consumption as would give the required sums for Government.

There is a mistaken notion that whilst taxation is injurious because it restricts consumption and affects the standard of living, loans are a painless means of raising money which can be readily resorted to without injury to the nation's standard of living. The truth is that if genuine savings are lacking, loans would in practice

be inflationary in effect and have the same result as veiled taxation with all its uneven incidence and economic instability. Therefore to secure sufficient restriction of consumption by taxation, by the rationing of supplies, and by loans, should be the objective of governments at war. There are however important considerations why taxation rather than loans should be resorted to to the maximum possible extent. There is a widespread fallacy that as between taxes and loans, it is better to have recourse to loans because the burden of a loan is thrown off to the future generation and that of taxation falls on the present. Nothing is farther from the truth. The war drains national wealth at once, here and now, by using up all potential capital, which would otherwise have flowed into productive industry, by the depletion of existing plant and by the depreciation of capital assets etc., and the country's resources acquired either by taxation or by loans are thus immediately used up. The nation as a whole is therefore at once impoverished. Nor is it correct to assume that taxation will not burden the future because it is possible that those who pay the tax may have taken it from funds which would otherwise have been employed in creating productive capital; just as the person who subscribes for a loan may have the funds saved from what he would otherwise have used in immediate consumption. In either case the restriction of consumption and the using up of the wealth unproductively cause damage immediately to the present generation. The real difference between taxation and loans is that although in both the burden is at once borne by the nation as a whole, under taxation the burden is also shared out immediately between the individual citizens, whereas under loans the sharing is postponed. The choice between taxation and borrowing is not therefore a choice between a heavier and lighter burden upon the nation as a whole but only one of equitable distribution among different sections of the community. It is only when nations borrow from abroad and acquire external resources that the burden is thrown off to the future generation.

If everyone in a country were in exactly similar position in wealth and income, the choice between a loan policy and taxation policy would be a matter of indifference. But some are rich and others poor. In such circumstances it is always desirable to rely more largely on taxation because under it more would necessarily come from the rich than from the poor. It is also right that the rich should pay more because the available margin after subsistence is progressively larger and because the deterrent to savings and enterprise which heavy taxation would cause in peace time would not

operate in war, because of the knowledge that the tax would last only for a short period of emergency. Again, since the poor in war time are left worse off than the rich on account of the fact that, as prices increase wages do not correspondingly increase, the proportion of revenue derived from taxing the rich should be relatively higher than that from the poor.

The lessons of the last Great War have not been lost upon the British Chancellor of the Exchequer this time. The war budget presented by Sir John Simon in September last came as a shock to many, but in view of the problem of war finance was no more revolutionary than the situation warranted. Since restriction of consumption is the only way by which larger resources would become available to Government, a steep rise in income and sur-taxes is not only a means of getting additional revenues but also of enforcing and ensuring private economy. The increase in the standard rate of income-tax to 7/6 in the £ combined with a sur-tax of 9/6 in the £ on incomes over £50,000 shows the extent to which the Government to-day is willing to depart from the practice during the last war of postponing taxation to the very end. The indirect taxes on alcoholic liquors, tobacco and sugar have also been increased. An Excess Profits Tax also has been levied on all profits in excess of the pre-war average. Despite these staggering taxes the extra revenue that they will bring in will only be about £226 millions in a full year, and upon the whole the total revenue for 1940-41 is estimated to be £1114 millions which will be about 50% of the total annual expenditure. Further taxation is, of course, possible and may even be necessary. But there are limits, both technical and economic, to imposing further taxation. So far as taxes on commodities are concerned, any steep rise in indirect taxes will affect the poor adversely and even if the taxes be on luxuries, unless all conceivable substitutes were taxed, they would fail to yield appreciable revenue. Hence rationing of all necessities and articles required for the conduct of the war is preferable to high taxation. Great Britain has now recourse to both price control and rationing in respect of several articles.

In this respect the present war affords a striking contrast to the last Great War. "Business as usual" was then the slogan which led to unfortunate results. To-day long before the first gun was fired or perhaps I should say, before love leaflets were scattered over the enemy country, the economic life was fully controlled. The production of all goods required for military purposes is in the hands of government, including their distribution and price fixing.

Since there are limits to taxation, a good portion of the resources required by Government must come from loans. But if loans are to be subscribed for from out of genuine savings, the utmost economy in the private consumption of goods would still be necessary. Although Government seeks to bring it about partly by its tax measures and by rationing supplies, there would still be room for voluntary action on the part of the citizens. Only then would genuine savings be created. To all those who are willing to economise in consumption, the economists would offer a word of guidance. Economise in all those articles of food like meat, bacon, eggs, etc., and others like petrol, coal, etc. which Government requires in large quantities. Economise in those machines and equipment which are useful for the purpose of producing articles of high military need. But those that are not useful for war purposes are unsuitable objects of private economy. As Prof. Pigou once said, if during a war a University desiring to economise has to choose between dismissing a teacher of Economics or a teacher of Chemistry and a teacher of Persian for example, it should dismiss the economist and the chemist and retain the Professor of Persian because the former might be employed in some war departments, whereas the latter would simply remain unemployed. The test in all cases is if what is saved by the citizens could be utilized in the war.

Savings, by themselves, would not be a guarantee that government could draw them all into their loan funds. Some more positive measures have to be taken to ensure this end. Here again the experience of the last war has stood the British Government in good stead. All investments in industry—not merely abroad but within the country—are completely banned or completely controlled. There is no opportunity for the private investor to use his funds in any industry without the permission of the Government. Hence all capital funds must go to the government, who will distribute them to the various industries according to the government's conception of the war needs. Priority certificates are issued to industries which serve war needs, and a complete rationing of all available capital has also been effected.

With a view to reducing the cost of borrowing and ensuring the success of the coming Defence Loans a policy of cheap money has been adopted. In striking contrast to the last war when the Bank rate was allowed to jump up from 4% to 10% and to continue at that high level, there has been to-day a much more conscious control of money conditions and after three months of war the rate is

still as low as 2%. New and more economical methods of raising loans have been explored, such as, the National Savings certificates and Defence bonds, the floatation of which was announced some days ago. The balance will be raised in the form of a big Defence loan on terms not exceeding $3\frac{1}{2}$ or 4%, which only four or five years ago would have been regarded as almost impossible. The fact is that governments are better prepared for the economic life of totalitarian states than for that of democracy.

What Great Britain has been attempting since the Munich Agreement, Germany has been doing for the last 5 years. So long as a nation has the will to continue on a low standard and to produce at any cost the minimum of necessities of life and of warfare, it can certainly conduct a war. There is no financial limit to its continuance. The real limit is partly psychological and partly economic. Germany will not be compelled by financial exhaustion to offer peace, because at worst if taxation and loans prove inadequate, there is the printing press to give command of resources. But a country cannot long carry on on that basis, as Germany knows to her cost. Economic breakdown is bound to follow if the national morale falls. Financially and economically the Germans had been paying the price of the war strain long before actual hostilities began. Germany has therefore much less reserve power than Great Britain or than she herself had in the last war when her industries were booming until almost the zero hour.

Anyhow, so long as a nation is able to supply from within all its requirements—by taxation, by loans or by inflation—the financial aspect will not be overwhelming. But if the nation has to buy abroad the position is entirely different. It is here that Great Britain has an advantage over Germany of almost incalculable value. One may grant that Germany is more self-sufficient and less dependent on foreign countries than the Allies. But Nazi Germany is at least as dependent on foreign raw materials and foodstuffs as was pre-war Germany. The vulnerability of her industrial machine is aggravated by the fact that most of the industrial raw materials have to come from countries under the control of the British fleet. Her dependence on imports for the supply of different commodities varies from 100 per cent in the case of cotton, rubber, zinc and nickel to about 75% in crude oil and benzoin. Even if Russia is able to supply some of her needs, the imports will have to be paid for. Russia is not financially so strong as to lend to Germany, and recently it was Russia that got credit from Germany. To pay for the necessary imports Germany must have cor-

responding exports, or gold reserves or foreign exchanges. She is lacking in every one of them.

Compare the financial position of Great Britain in this respect. Great Britain is a big creditor country deriving a large amount of income from her foreign investments. The income she so derives could be used to buy up the goods she needs from abroad. If that be inadequate, she could sell these foreign securities in U.S.A. and utilise them for financing her imports. She has thus an element of financial strength which no other nation, not even the U.S.A., enjoys. As soon as war was declared, Great Britain took power to recruit all financial assets from private citizens with a view to using them for financing the war-time supplies. All securities payable in foreign currencies were to be registered at the Bank of England and powers were taken to acquire all securities which are likely to be marketable outside the United Kingdom. They could be used as collateral security for borrowing from U.S.A. or they could be sold outright in order to buy dollar exchange. Britain's foreign holdings in investment trusts, insurance companies, etc., which could be thus utilised for discounting in the U.S.A. capital market are estimated to be of the value of over £1100 millions. She could therefore easily offer cash and carriage for all the aircraft and materials she imports. Germany's chagrin at the repeal of the U.S. Neutrality Act can well be understood against this background.

But if the war lasts three or four years, even Britain's external assets will not be adequate. She must therefore conserve them to the very end. In the meanwhile, complete control of foreign exchanges with a view to using them for financing necessary imports is absolutely essential, and this the Government has already done. All foreign exchange transactions are completely controlled and centralised, and there are now no private dealings in exchanges. For no amount of internal resources would help a country in paying for its imports. The only way of paying for them is to increase exports; but difficulties arise on account of the fact that the shortage of capital and labour available for use in foreign trade and in the production of export goods threatens to make it impossible for a belligerent country to provide the necessary exports and buy the necessary imports. Hence apart from other steps to conserve available foreign money, it is necessary to diminish imports as much as possible by restricting them to goods wholly indispensable. A nation at war should consume only home goods as far as possible. Available capital and resources must be diverted for making com-

modities for home use and turning them if possible into articles for export. Exports should be encouraged and priority should be given to export industries. In these and other ways, a nation can import the essentials of war.

The British Empire is a strong economic unit. Within the Empire could be produced nearly all the essential articles of war. So long as Great Britain has a surplus of exports to finance her imports from neutral countries, the financial problem of the war can present no serious difficulty to her. The goods that she gets from Dominions and India could be paid for by her exports; but even if her exports are inadequate, nothing should prevent these countries from lending to Britain. During the last war, India made a gift of £100 millions to Great Britain. Apart from its monetary aspect, its value really consisted in this that Britain was able to get goods from India without having to find the necessary exports thereto. India can to-day lend capital if she wills. Her contribution to the success of this war might still be as valuable as in the last war, and Great Britain should not miss the opportunity.

ON THE MORPHOLOGY, LIFE-HISTORY AND CYTOLOGY OF *RICCIA HIMALAYENSIS* ST.*

By •

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The morphology and life-history of several species of *Riccia* have been investigated by various workers. In India about fourteen species of *Riccia* are recorded so far. Most of the records are mainly taxonomic in nature; and detailed morphological and life-history studies have been made in the case of only three species, viz., *Riccia sanguinea* Kash. (Pande, 1924), *R. robusta* Kash. (Pande, 1933) and *R. fluitans* L. (= *Fysonia tenera* Kash.) (Kashyap and Sethi, 1923).

Riccia himalayensis St. occurs in plenty in Madras during the N. E. monsoon seasons and advantage was taken of this to work out in detail its morphology, life-history and cytology.

The liverwort grows in soils which are moist, compact and coarse grained and well drained. In Madras, it generally grows in exposed areas, such as open fields and waste-lands. It is also very common in the evergreen scrub jungles at Vandalur and other similar places near Madras. In these latter places it is found on the shady moist regions near the foot of the hills and also on the moist soil under cacti and other scrub bushes. The liverwort comes up quite early after the summer monsoon rains and attains a luxuriant growth during November and December. It is usually found associated with some blue-green algae† (*Nostoc Passerianum*, *Scytonema ocellatum*, *Schizothrix pallida*, *Microcoleus Steenstrupii*) often growing on the thin dark brownish felt formed by the latter on the soil.

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† I am indebted to Prof. Iyengar for the identification of the blue-green algae associated with the present liverwort.

Material and Methods.

The material for this investigation was collected mainly from the Madras Agri-Horticultural Society Gardens and also from some open uncultivated areas in Adyar, a suburb of Madras. The material, as soon as collected, was washed carefully in water to remove all the adhering soil particles and fixed immediately. An exhaust pump was used to ensure proper fixation. The following fixatives were used:—(1) Strong chromo-acetic solution with 1% osmic acid, (2) Flemming's fluid (Stronger solution) and (3) Allen's modification of Bouin fluid, (P. F. A. 3). Of these Flemming's solution and Allen's P. F. A.3 mixture gave the best results. The material was washed thoroughly in water in the case of chromo-acetic mixtures and with 50% alcohol in the case of the Allen's fluid, and then taken through the usual grades of alcohol and xylol and finally imbedded in paraffin (56-58° m.p. Grubler's). Sections were cut from 2 to 25 microns thick and stained in Heidenhain's iron-alum haematoxylin and mounted in neutral canada-balsam.

The plants, when fully grown form rosettes (Fig. 104), but when growing close to one another often become irregularly overlapped. The thallus is fairly robust and dark green in colour and measures 8 to 12 mm. long and 3 to 5 mm. broad. It has a distinct dorsal median groove and possesses a prominent apical notch with broadly rounded elliptic or oblong lobes. The thallus is generally once forked, but is very often forked twice or even thrice. The amphigastria, which are purple in colour, project a little beyond the sides of the thallus and are curved slightly over the dorsal surface. In cross section the thallus is nearly three times as broad as high.

The growth of the thallus is by means of an apical cell, which is situated in the notch of the thallus. This apical cell is triangular in a median vertical section (Fig. 7) and more or less trapezoidal in a section taken parallel to the surface of the thallus (Fig. 8). It appears therefore to be a four sided pyramidal one. It is rather difficult to locate the apical cell in a section which is parallel to the surface of the thallus. In such a section the anteriormost part is seen to be made up of a number of very regularly arranged cells of more or less uniform size, with rich protoplasmic contents and a prominent nucleus in each. The apical cell can be recognised among these anterior cells by its slightly larger size. But in a median longitudinal section, the apical cell is at once distinguished by its anteriormost position and

its triangular shape. The apical cell cuts off segments, dorsally, ventrally and laterally as in other species. The dorsal segments give rise to the assimilatory tissues and the reproductive organs, while the ventral segments give rise to the amphigastria and the rhizoids. The lateral segments add to the formation of the wings of the thallus. The apical cell is well protected from external injury by the incurving filamentous outgrowths of the neighbouring dorsal cells and also by the amphigastria.

On the dorsal surface, immediately behind the apical cell are seen a series of cells, densely filled with protoplasm and having a large nucleus in each. For a short distance behind the apical cell, the cells are compact and without any intercellular spaces between them. Then comes the region showing the air-chambers in various stages of formation. The air-chambers are formed through the splitting of the vertical walls of some adjacent cells (Fig. 9). The split is *endogenous in origin* and starts a few layers below the epidermal layer and then extends both upwards and downwards. The young chambers are often formed somewhat deep in the tissue of the liverwort and do not communicate with the outside. After some time the slits stop extending downwards, but continue to extend upwards until they become completely open on the dorsal side. The fully developed chambers do not expand very much laterally inside the thallus, but remain merely as slits throughout (Fig. 10).

In the apical part, the assimilating portions grow forwards and arch over the extreme apex. The terminal cell of each row of cells is slightly larger than the remaining ones and is more or less rounded or rounded mammilliform above (Fig. 10). The chloroplasts disappear very early in these terminal cells.

The ventral portion of the thallus is compact and free from intercellular spaces and is composed of six to seven layers of cells. These cells are irregular in outline in the older parts but more or less angular in the younger parts and contain a few chloroplasts scattered inside. The lowermost layer is more or less continuous and forms a sort of a ventral epidermis. The cells in this layer are more elongated at right angles to the length of the thallus. In the young portion of the thallus a few large cells containing a very large nucleus and some deeply staining material are scattered in this layer. The ventral scales and the rhizoids generally start from these cells (Fig. 11). The ventral scales are simple at first (Fig. 12), but soon become ruptured in the middle and

appear as two lateral scales in the older parts of the thallus. The rhizoids are usually of two kinds, both smooth and tuberculate are present in this liverwort as in the other species.

Antheridium.

The plants are monoecious and protandrous. The development of the antheridium is quite similar to what has been recorded in the other species of *Riccia*. On the dorsal surface, just behind the apical cell, a few cells away from it, one of the cells grows out into a papillate structure and forms the antheridial initial (Fig. 14). This cell which is generally ovoid in shape forms a row of four superimposed cells by two successive transverse divisions (Fig. 16). Up to this stage, all the four cells of the row are rich in protoplasmic contents. But the lowermost cell soon gets poorer in contents and does not divide much (Figs. 17, 18). It later on becomes the short stalk of the antheridium. The three upper cells divide vertically by longitudinal walls (Fig. 18). Vertical walls are then formed at right angles to the previous ones. At this stage a cross section of the antheridium shows that the segments are divided into quartets (Fig. 19). After this, periclinal walls are cut off, separating a wall-layer from a central group of cells (Figs. 20, 21, 22). The cells inside the wall-layer then divide repeatedly and form a number of small, very regularly arranged cubical sperm-mother-cells (Fig. 23). The cells of the wall-layer also divide and keep pace with the growth of the central cells. The wall is always single layered and in surface view is made up of long narrow cells, with very poor contents. As the antheridium develops further, the wall-layer becomes thinner and thinner until finally the contents of its cells disappear completely and the wall is distinguishable only as a very thin membrane surrounding a mass of sperm-mother-cells. Simultaneously with the development of the antheridium, the cells adjoining it also divide and grow vigorously (Figs. 15, 16, 18, 21, 23). Finally they grow past the antheridium which then appears as if lodged in a deep chamber. The beak of the antheridial chamber is narrow and often projects far beyond the dorsal surface of the thallus and is slightly inclined forwards towards the apical region of the thallus.

Spermatogenesis

As repeated divisions occur in the cells of the antheridium, they become very much smaller in size and cubical in shape. The

nuclear spindle is generally either parallel or diagonal in the earlier divisions but is invariably diagonal in the final division. Just before the commencement of the final division, in the sperm-mother-cell, a dark body appears in the cytoplasm very close to the resting nucleus (Fig. 69). This body could not be seen in any of the cells before this stage. In a number of cells during early prophase, two such dark bodies were seen close to the nuclear membrane (Fig. 70). These two bodies are evidently derived from the single body seen close to the resting nucleus through division. During metaphase these two dark bodies are seen one at each pole of the spindle (Fig. 71). The behaviour of these two dark bodies is very similar to that of a centrosome and they may therefore be considered as centrosomal in nature. No asters, however, were seen at any time round them. Each sperm-mother-cell gives rise to two spermatids and all the spermatids develop more or less simultaneously. No cross-wall could be seen separating the two spermatids after division in my material. But Durand (1908) in his paper on *Marchantia polymorpha* reports that "According to Ikeno (1903) and Campbell (1905), this final division is unaccompanied by a wall in *Marchantia* and *Fimbriaria*. My own preparations stained with Delafield's hematoxylin, which brings out cell-walls clearly, shows diagonal walls very distinctly in some of the cells, but not in all, so that they seem to disappear soon after being formed."

In *Riccia himalayensis*, the young spermatid is more or less triangular in shape with the nucleus close to its base (Fig. 72). The cytoplasm is evenly granular and the chromatin material of the nucleus is seen as a sort of an irregular network. The dark body already referred to in the sperm-mother-cell is now situated near its apex. This body then begins to be drawn out gradually and soon appears as a darkly curved thread-like structure, running along the surface of the body of the spermatid to some distance (Fig. 74). At the same time the shape of the spermatid becomes more and more rounded. A small space or vacuole appears in the centre of the cell (Figs. 73, 74, 75, 77). As the vacuole increases in size, the nucleus is gradually shifted to one side of the cell (Figs. 76, 77). By this time the nucleus loses its reticulate appearance and becomes more or less homogeneous. At the same time it gets elongated more and more, but narrowed at one end and broadened at the other, the narrower end being directed towards the side occupied by the elongated dark body mentioned above. As both the nucleus and the dark body continue to elongate, their two ends appear to grow past each other. At this stage

their two ends appear to overlap and in close contact with each other, the elongated end of the dark body lying over that of the nucleus. The immediate further stages could not be followed in the material. The next stage that was found was the fully developed spermatozoid. The mature spermatozoid is a coiled thread-like structure with a pointed anterior end and a broader posterior end (Fig. 78). The anterior end of the spermatozoid is really made up of two portions, viz., (1) the extreme tip consisting of the free portion of the elongated dark body, and (2) the portion immediately below consisting of the overlapping ends of the elongated dark body and the elongated nucleus. Two long cilia are formed at the anterior end. They are as long as the body of the spermatozoid, and are attached a little behind the anterior end, which appears as a sort of a beak. The cilia take their origin a little below the extreme tip at a place corresponding to the lower part of the elongated dark body (Fig. 78). Since the cilia appear to arise from this elongated dark body, the latter may be presumed to represent the blepharoplast.

Some authors are of the opinion that an undoubted centrosome is present in liverworts. But a number of other authors think that no centrosomes are ever formed in the group*. Ikeno (1903) records true centrosomes in *Marchantia polymorpha*, Allen (1917) in *Polytrichum juniperinum*, Wilson (1911) in *Pellia epiphylla*, and Walker (1913) in *Polytrichum*. According to these authors, the centrosome persists till after the last division of the antheridial cells and finally becomes the blepharoplast. Lewis (1906), Black (1913) and Woodburn (1911) on the other hand think that the centrosome-like bodies found in the antheridia are only of *kinoplasmic origin* and should not be considered as centrosomes. Atwell (1914) found centrosome-like bodies in the antheridia of *Riccio-carpus natans*, but did not regard them as permanent organs, since they arose and disappeared with each division. Woodburn (1911) has recorded the formation of darkly staining bodies in the sperm cells of various bryophytes, but states that they are all of cytoplasmic origin and that there is nothing in their behaviour to indicate that they are centrosomes. According to him, the blepharoplast represents merely the individualised parts of the kinoplasm arising *de novo* in the spermogenous cells.

* For earlier literature on this subject refer to Wilson (1911) and Woodburn (1911).

In the presence of this controversy, the behaviour of the two dark bodies occupying the poles of the spindle in the sperm-mother-cells of this liverwort may throw some light on this question. As already pointed out, just before the final division in the antheridium, a dark body is seen close to the resting nucleus and by early prophase, this dark body is seen already divided into two and at metaphase these two bodies are seen occupying the poles of the spindle and persist even after division in the daughter cells (spermatids). In these spermatids, they gradually elongate and ultimately form the blepharoplast. The blepharoplast may therefore be traced to the original dark body found close to the nucleus during early prophase in the sperm-mother-cell. Of course, no asters could be seen, but the position of this dark body in the sperm-mother-cell and its behaviour in the final division very strongly suggest that it is a centrosome.

During the development of the spermatozooids, there are found a large number of black round bodies scattered in the midst of the spermatozooids. These bodies vary in size and persist even after the formation of the mature spermatozooids. Such bodies have been reported by Pande (1924) in *Riccia sanguinea*. Similar bodies were observed by me in the antheridia of *Riccia fluitans* also. The nature of these bodies is not very clear.

Archegonium.

A number of archegonia is developed in a row on the dorsal median portion of the thallus. The development of the archegonium is quite normal. It starts as a hemispherical papillate outgrowth, a few cells behind the growing point (Fig. 24). A transverse wall soon divides this papillate cell into an upper body-cell and a lower stalk-cell (Fig. 25). In the upper cell, which projects a little above the level of the adjoining cells, vertical walls are formed cutting off three peripheral cells and a primary central-cell (Figs. 25, 26). By a transverse division, a cap-cell is cut off from the primary central cell. The central-cell divides again by another transverse wall into an upper and a lower cell (Fig. 27). The upper cell, by a series of divisions gives rise to the axial row of neck-canal-cells and the lower to the ventral-canal-cell and the egg-cell (Figs. 28-31). During the formation of the axial row of neck-cells, the wall-layer also divides simultaneously and forms a jacket round the axial row of cells. In a well developed archegonium, the venter

becomes much swollen and the archegonium becomes flask-shaped (Figs. 31-34). The egg is not perfectly spherical, but appears flat at the top where it abuts on the ventral-canal-cell (Fig. 32). It measures about 35-38 μ in diameter and its nucleus about 12.5 μ . The cytoplasm of the egg is evenly granular. The ventral-canal-cell appears as a somewhat truncated conical cell (Figs. 32, 33). The egg and the ventral-canal-cell almost completely fill the space inside the venter. The neck-canal-cells appear as linear rectangular cells in longitudinal section. The largest number of neck-canal-cells noticed was six.

As the archegonium enlarges, the adjoining cells also divide very rapidly and soon grow past the archegonium, with the result that the latter is ultimately left as it were sunk in a chamber in the thallus of the liverwort. Usually only one archegonium is found in each chamber. Occasionally two archegonia are formed in one chamber (Fig. 34). They are seen sometimes touching each other by their sides, while in other cases they are quite separate. The presence of two archegonia in one chamber has been recorded in *Riccia robusta* by Pande (1933) and in *Spaerocarpos Donnellii* by Rickett (1923).

Fertilisation.

At the time of fertilisation, the archegonium is open above and the neck region is filled with the disorganised material of the neck-canal-cells (Fig. 33). The disorganisation of the neck-canal-cells usually proceeds from the top downwards. The ventral-canal-cell also completely disorganises before fertilisation and the egg becomes quite spherical and occupies more or less the whole of the venter region (Fig. 34). The ventral-canal-cell does not disintegrate along with the neck-canal-cells. In archegonia, which fail to be fertilised, the ventral-canal-cell is still seen, though somewhat shrunken, while the neck-cells are all completely disorganised. The egg also in these archegonia becomes much shrunken and its nucleus shows signs of degeneration. Ultimately both the egg and the ventral-canal-cell become completely disorganised. These observations are quite in agreement with those of Garber (1904) made in *Ricciocarpus natans*. He found that the breaking down and the resorption of the ventral-canal-cell was dependent on the entrance of the sperms and that the ventral-canal-cell, though in the process of degeneration, could still be seen in all archegonia which failed to be fertilised. He also found that the egg in such archegonia become much shrunken and ultimately disorganised completely along with the ventral-canal-cell.

A large number of spermatozoids enter through the neck of the archegonium and reach the venter region. The actual penetration of the spermatozoid into the egg was not observed in the material. But several fertilised eggs showing the male nucleus in different positions inside the egg-cell were found. In a few cases the actual fusion of the male and the female nucleus were also observed.

The spermatozoid, after its entry into the cytoplasm of the egg, loses its vermiform shape and becomes somewhat ovoid (Figs. 35, 101). It takes a deeper stain than the female nucleus, and is very prominent in the preparations. It is also much smaller than the female nucleus measuring only 5 μ by 8 μ whereas the female nucleus measures about 12 μ in diameter.

The female nucleus is almost spherical and is more or less centrally placed in the egg. As the male nucleus moves closer to the female nucleus, the latter becomes somewhat flattened on the side directed towards the male nucleus and later on gets slightly depressed at this region. The male nucleus is received in this depression. The nuclear membrane of the two nuclei break down at the point of contact, but remain in tact over the remaining free surfaces of the two fusing nuclei. At this stage the male nucleus appears as a beak-like projection of the female-nucleus (Fig. 103). Later on, the nuclear membrane of the two fusing nuclei completely disappear and the fused nuclear portion becomes more or less spherical and is seen surrounded by a colorless region.

During fertilisation, the cytoplasm of the egg becomes alveolar (Fig. 35) and at certain stages presents a coarsely reticular structure (Fig. 103). Two regions could be distinguished in the egg, a slightly staining typically alveolar peripheral portion and a more deeply staining coarsely reticular inner portion (Fig. 101). Finally, however, this distinction between a peripheral and a central region is lost and the contents of the fertilised egg become more or less homogeneous.

Before the actual fusion of the two nuclei, a small portion of the cytoplasm close to the male nucleus is seen stained somewhat more deeply than the remaining cytoplasm of the fertilised egg (Fig. 101). This is evidently the cytoplasmic portion of the spermatozoid still remaining distinct inside the cytoplasm of the egg.

At certain stages, very minute, darkly staining spherical bodies are seen in the cytoplasm of the egg at the peripheral region

(Fig. 35). These bodies are either single or arranged in groups of two or three. Their sizes vary from very minute and indistinguishable specks to somewhat large, clearly defined spherical bodies. Similar bodies were found by Motte (1932) in various liverworts and mosses. He thinks that these bodies are mitochondrial in nature (cf. Motte, Pl. II, Fig. 20, p. 141).

In a few cases, fine protoplasmic strands were seen radiating from the surface of the egg-cell and attaching themselves to various points on the inner wall of the venter, across the gap between the egg and the inner surface of the venter (Fig. 103). The points where the strands are in contact with the surface of the egg stain somewhat deeply. These strands appear to be of the same nature as those recorded by Beer (1906) in the spore-mother-cells of *Riccia glauca*, where on the rounding off of the protoplast, secondary and later tertiary thickening layers are deposited. The secondary thickening layer becomes mucilaginous and sometimes separates completely from the primary wall and then forms an external envelope to the mother-cell, whilst at other times it still remains partly adherent to the primary wall, and in that case it becomes drawn out into strands of mucilage bridging over the space between primary wall and tertiary thickening layer.

In the earlier stages of fertilisation, the chromatin material of the male nucleus is in the form of a dark mass in the middle, with fine radiating strands (Fig. 101). But later on the chromatin content is seen as short curved rods and irregular masses, more or less evenly distributed inside the nucleus. In the female nucleus, however, the latter condition seems to be the rule throughout (Fig. 35). The chromatin masses of the male and female nuclei could still be recognised as two distinct dark masses for some time inside the fusion nucleus. Ultimately they become mixed up and indistinguishable from each other. The fusion nucleus finally forms a fresh nuclear membrane of its own.

Sporophyte.

The fertilised egg, after a short period of rest enlarges and divides by an oblique wall formed at an angle of 45-60° to the long axis of the archegonium, into an epibasal and a hypobasal cell (Fig. 36). Hofmeister (1862; cf. Pl. xii, fig. 16b) states that in the zygote of *Riccia* after the first division "the upper of the two newly formed cells is then divided by a septum inclined in the opposite direction" Campbell (1928), however, found that in *Riccia glauca*

the hypobasal cell divided first and not the epibasal cell. Black (1913) found that in *Riccia Frostii*, the first division wall is oblique but the second division may be either at right angles to the first wall or parallel to it, resulting in a row of three cells. In *Riccia himalayensis*, the epibasal cell divides first by a wall at right angles to the first wall (Fig. 37), and then the hypobasal cell also divides by a similar wall and this latter wall is more or less in a line with that formed in the epibasal cell (Figs. 38, 39). After this, an octant stage is formed by the division of each of these four cells by anticlinal walls. Further divisions soon follow in this globular embryo and a sixteen celled structure results. The shape of the embryo at this stage is not spherical but somewhat elliptic across. After this stage, periclinal walls are formed in almost all the cells, finally cutting off a wall layer (amphithecium) from a central group of cells (endothecium) (Fig. 40). The cells of the wall layer are narrow and rectangular in section and their nuclei are comparatively smaller than those of the central group of cells. These latter cells by repeated divisions give rise to the sporogenous cells, which are closely packed and polygonal in shape (Figs. 41, 42). The cells of the amphithecium then became binucleate (Fig. 41).

Division of the Spore-Mother-Cell.

The contents of the sporogenous cells contract away from the walls of the cell and remain as spherical masses in the centre (Fig. 43). At this stage, the original mother-walls of all the sporogenous cells appear as a sort of a delicate network about the rounded protoplasts. These rounded protoplasts soon form walls of their own and become the spore-mother-cells. At a later stage, the old net-work formed by the old walls of the original sporogenous cells are completely disorganised and the spore-mother-cells surrounded by their own walls lie loose inside the distended wall of the venter. About this time, the cells of the amphithecium layer gradually disorganise and their contents become slowly absorbed by the developing spore-mother-cells. The amphithecium completely disappears by the time the spore-tetrads are formed.

An accumulation of gelatinuous substance or nutritive material about the spore-mother-cells is reported in *Ricciocarpus natans* (Garber, 1904), *Riccia crystallina* (Pagan, 1932) *Thallocarpus Curtissi* (Mc Allister, 1916) and *Riccia Frostii* (Black, 1913). But no such material could be detected about the spore-mother-cells in the present liverwort.

The spore-mother-cells undergo two divisions of which the first is a reduction division, the details of which will be dealt with in the following pages. As a result of the two nuclear divisions, four daughter nuclei are formed which then occupy a more or less peripheral position. The protoplasm of the divided spore-mother-cells at this stage appears much vacuolated and a few plastids are dispersed in the cytoplasm. Soon after, cleavage takes place in the spore-mother-cells dividing them into tetrads, enclosed within the old mother-wall. Each cell of the tetrad is then surrounded by a thin membrane of its own. Inside the primary wall of each tetraspore, secondary wall layers are laid down by the protoplasm and the spore coat gradually increases in thickness by the continued apposition of such layers from within. About this stage, the thickenings of the spore coats of any two adjoining spores appear as many pillow-shaped areas (Figs. 45, 46). If at this stage, a section of the spore is treated with chlor-zinc-iodide after previously treating it with concentrated sulphuric acid and chromic acid solution, the several lamellae of the coat (exospore) can be very clearly seen. Inside this coat an endospore is finally deposited. The exospore in the ripe spore is reticulately sculptured and quite black in colour. The interior of the spore is filled with a thin layer of cytoplasm in which a large number of starch grains is distributed (Fig. 47).

In a few sporophytes, a number of spore-mother-cells showed signs of degeneration. These cells were either globular or irregular in shape (Figs. 48, 102). In some of them the formation of the primary walls of the young tetrad could be seen. But these cells were much stunted in growth, while in others the protoplasm and the nuclei were in various stages of disorganisation. Such sterilisation of the spore-mother-cells have been recorded by Pagan (1932) in *Riccia crystallina*. The sterile cells in *Riccia* were regarded by Pagan as the forerunners of the elaters of the other Hepaticae and the failure of potential sporogenous tissue to produce spores were considered mainly a matter of food supply.

Soon after fertilisation of the egg, the wall of the venter divides periclinally and becomes two layered (Figs. 35, 36). This two layered wall of the venter grows and keeps pace with the enlarging sporophyte. But as the sporophyte matures, the inner layer of the expanded venter disorganises. The cells of the outer layer continue to live and contain a large number of chloroplasts. Their walls become much thickened and dark brown.

In the completely ripe sporogonium the spores lie quite free inside the cavity of the venter. There is no special mechanism by which the sporogonia could dehisce. The liberation of the spores evidently takes place through the disintegration of the wall of the venter. The tissue of the gametophyte around the sporogonium also dies so that when dry, dark masses of spores could be seen in small cavities along the middle line of the dried up specimens.

Germination

Attempts were made to germinate the spores in the laboratory, but without success. But when the soil in which *Riccia* was growing in the previous year was examined after the summer monsoon rains, several germinating stages were obtained. After washing the soil several times with water, the germlings were separated from the soil particles with the aid of a Greenough Stereoscopic dissecting microscope.

During germination the outer coat of the spore bursts and the contents of the spore grow out enclosed by the inner coat as a germ-tube (Fig. 1). Pande (1924) states that the germination in *Riccia sanguinea* never took place by the dehiscence at the tri-radiate mark, but by means of a germ-pore formed in the convex surface of the spore wall opposite to the tri-radiate mark. In the case of *Riccia cupulifera* also (Duthie & Garside, 1936), the germ tube is produced from the same region. In the present material also, the germination takes place by a germ-pore formed in the convex side opposite to the tri-radiate-mark and is therefore similar to what has been recorded in the above mentioned species of *Riccia*.

In the earliest stages obtained by me, the germ tube had already grown out to a fair extent and the outer wall of the spore appeared like a loose cap over the spore portion. A number of chloroplasts is seen in the germ tube. It continues to grow and sooner or later a number of walls is formed in different planes at the tip forming a mass of cells (Fig. 2). Further development of these cells leads to the formation of a small flattened thallus (Figs. 3-6). Rhizoids are formed rather late. The first rhizoid starts from the base of the germ-tube.

Remarks on the Seasonal Activity of the Liverwort

The Madras year may be divided into four seasons, viz., (1) the sultry South-West monsoon season (July-September), (2) the

cool North-East monsoon season (October-December), (3) the cool dry season (January-March) and (4) the hot dry season (April-June). The total average rainfall for the year is 52 inches.

The Sultry South-West Monsoon (July-September). During this season, the temperature and humidity are rather high and light showers are frequent, but the total rainfall for the whole period is only about 3 to 8 inches. The weather is often cloudy and sultry.

The Cool North-East Monsoon (October to December). During this season, the temperature comes down very much and the humidity increases to its maximum. This is the real rainy season of the year, the rains often continuing for days together. The average rainfall for this season is about 20-30 inches. The weather is generally cool and cloudy throughout.

The Cool Dry Season (January-March). This season is characterised by bright sunshine, with more or less a clear blue sky. During this period there is very little or no rainfall, the average rainfall being 2-6 inches; but the humidity still continues to be fairly high. The temperature falls considerably and reaches its minimum.

The hot dry season (April-June). The temperature reaches its maximum during this season. There is usually no rainfall during this part of the year and the humidity is also at its minimum. The average rainfall for the season is 3 inches. There is very strong sunshine and the weather is hot and severe.

A month or so after the commencement of the summer monsoon rains (about August) the tiny perennating apical portions of the plants of the previous year are seen as small green plantlets. An examination of the soil at this time also shows a number of germinating spores in various stages of growth. During the heavy rains of the N. E. monsoon season (October-December) the liverwort grows very rapidly and soon attains its maximum growth. It forms antheridia first and later on archegonia. By the end of the N. E. monsoon rains (December) the antheridia all get emptied and only the sporogonia are found in the plants. During the cool dry season (January-February) the soil gets gradually drier and drier and the growth of the liverwort is also very limited. Towards the end of March the sporogonia break up and the spores could be seen lying free on the dorsal surface of the liverwort. At the same time the posterior portion of the liverwort dies out gradually. Towards the end of the season, most of the plants are

dead but in the case of a few plants, the extreme apical portions do not die but persist as perennating organs and tide over the long dry and hot summer season quite unharmed and become active again and grow out into new plants after the next summer monsoon rains.

Mitotic Division

The process of mitosis were followed both in the thallus and in the cells of the antheridium and the details in both cases were essentially similar. As repeated divisions occur in the antheridial cells the nuclei become very small and the cytological details are then difficult to follow. In the prophase there appears a fine reticulum, which in the earlier stages does not completely fill the nuclear space (Fig. 51). Extremely tiny chromatin granules of various sizes could be made out on the threads of the reticulum (Fig. 52). Later on, the threads become thicker and the chromatin material become more evident and the coiled threads appear to completely fill the space of the nuclear cavity (Fig. 53). In late prophase, these threads become thicker still and very much contracted and finally become distinguishable as individual chromosomes (Figs. 54, 55, 80). These chromosomes are long, thick, curved and rod-like and are evenly distributed in the nucleus mostly near the periphery of the nuclear cavity which then appears clear inside. During early metaphase further contraction of the chromosomes takes place and the chromosomes stand out separate and distinct (Figs. 56, 57). The nuclear membrane then disappears and later on the nucleolus also. A well defined spindle is formed very soon and the chromosomes are then seen arranged in a plate. Many metaphase plates in polar view were found in the preparation which made it possible to obtain a clear count of the chromosome number. The haploid number of chromosomes is eight, of which seven are long, rod-shaped and slightly curved and one very small and rounded (Figs. 58-61, 81). The small round chromosome was always seen to be situated in the centre of the group of the metaphase chromosomes. During anaphase, as the chromosomes move towards the poles, the tiny chromosomes were always found to precede the others (Figs. 64, 65, 83, 84). During telophase the chromosomes at the poles undergo much contraction and could be seen only as black masses at either poles (Fig. 67). Later on, these organise as two daughter nuclei, with the spindles still extending between them (Figs. 68, 86). A cell-plate is then formed between them

and the spindle finally disappears. A cross-wall is formed dividing the cell into two.

Mitosis in the Sporophytic Cells

The details of mitosis followed in the cells of the developing sporophyte were quite similar to those observed in the vegetative and reproductive cells of the liverwort. The prophase stages show nothing very peculiar as to call special attention here. At metaphase, fourteen long and two small chromosomes could be made out. The long chromosomes could be distinguished easily, but the two small ones could be seen only in very favourable preparations. The difficulty in seeing these tiny chromosomes is due to their small size and their being generally overlapped by the long ones. During anaphase the tiny chromosomes can be seen clearly as they invariably precede the longer ones. At telophase the individual chromosomes could not be made out, but they are massed together. Finally two daughter nuclei are formed and the cell divides by a wall into two.

Meiosis

The nucleus of the spore-mother-cell is fairly large measuring about 15μ in diameter and contains mostly a single nucleolus which measures about 3.75μ in diameter. In the leptotene stage, the nucleus contains very faintly staining and much convoluted fine threads. The nucleolus is perfectly round at this stage (Fig. 87). In the zygotene stage, the threads are found in pairs and in favourable preparations a number of free ends could be made out inside the nucleus (Fig. 88). Owing to the fact that the threads are very slender and stain only very faintly at these stages, it was not possible to trace the threads along their length. At the pachytene stage, the threads begin to contract and at the same time take more stain than during the previous stages. After this stage, they contract still further and become very much thickened and form a dense mass about the nucleolus (synezeisis) (Fig. 89). At a later stage the threads appear to be twisted and forming loops (Figs. 90, 95). Further contraction takes place in these threads until at diakinesis definite bivalent chromosomes are formed and they are usually found to be distributed evenly near the periphery of the nucleus (Figs. 96, 97). In the metaphase plates eight bivalents are observed of which seven are long and one small and spherical (Figs. 93-94). No anaphase stages could be seen in my material.

In the present material, I was not able to observe the homeotypic division in the spore-mother-cell. The process is probably of a brief duration and rapid and so was missed.

A word may be said about the behaviour of the nucleolus. During the early stages, the nucleolus is spherical, but soon becomes lobed in appearance (Fig. 89), and gradually becomes disorganised and at metaphase its presence could not be detected. During the process of disorganisation, they are stained dull with heamatoxylin and often are seen to assume various irregular shapes.

Summary

1. *Riccia himalayensis* St. is a very common liverwort in Madras, coming up regularly during the rainy seasons (September-December). The plants grow usually on hard and compact soil and are generally in association with some blue-green algae.
2. The structure and development of the gametophyte is described in detail.
3. The plants are monoecious, but protandrous. The development of the antheridia and the archegonia is described in detail. Their development is normal.
4. In the last division of the sperm-mother-cell centrosome-like bodies appear, and during division stages are seen to occupy the poles of the spindle. These bodies appear to give rise to the blepharoplast from which the two long cilia of the spermatozoid are formed.
5. The largest number of neck-canal-cells observed in the archegonia was six. Occasionally two archegonia are seen developing in one chamber.
6. Stages in the fertilisation of the egg are described.
7. The development of the sporophyte is described in detail. The first division of the zygote is obliquely transverse.
8. The development of the spore is described in detail. Some of the spore-mother-cells become sterile.
9. The germination of the spore and the development of the young gametophyte are described.
10. The haploid number of chromosomes is eight of which seven are long and one very small and round. The mitotic and the meiotic divisions are described in detail.

In conclusion, I have great pleasure in expressing my indebtedness to Prof. M. O. P. Iyengar, M.A., Ph.D. (Lond.), F.L.S., for his suggesting the problem and his constant guidance and helpful criticisms throughout the course of this work. My acknowledgments are also due to the Authorities of the University of Madras for the award of a Research Scholarship, during the tenure of which the present investigation was carried out.

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EXPLANATION OF FIGURES

- Fig. 1. Spore germination×50.
- Fig. 2. Germ-tube forming a mass of cells at the apex×50.
- Figs. 3-6. Development of a young gametophyte 3, 4, 6×50. 5×200.
- Fig. 7. Median longitudinal section of the thallus showing the apical cell, a few dorsal cells and the ventral scales×320.
- Fig. 8. Section taken parallel to the surface of the thallus showing the apical region×250.
- Fig. 9. Development of air chambers×250.
- Fig. 10. Vertical section through the thallus×80.
- Fig. 11. Ventral epidermis showing cells with dense contents and large nuclei from which the amphigastria arise×320.
- Fig. 12. Section of the thallus through the apical region with simple median ventral scales×250.
- Fig. 13. Dichotomous branching of the thallus×250.
- Fig. 14. Antheridium initial×320.
- Fig. 15. Antheridium showing the two celled stage×320.

- Fig. 16. Antheridium showing four celled stage $\times 320$.
- Figs. 17, 18. Vertical wall formation in the antheridium $\times 320$.
- Fig. 19. Cross-section of the antheridium after the formation of two vertical walls at right angles to each other $\times 320$.
- Figs. 20, 21, 22. Formation of the wall-layer of the antheridium, 20, 21 $\times 320$. 22 $\times 350$.
- Fig. 23. A well developed antheridium $\times 250$.
- Figs. 24-33. Various stages in the development of the archegonium. 24 $\times 300$. 25 $\times 260$. 26, 27 $\times 360$. 28 $\times 260$. 29-33 $\times 200$.
- Fig. 34. Two archegonia in one chamber $\times 200$.
- Fig. 35. Fertilisation $\times 300$.
- Fig. 36. First division of the Zygote $\times 300$.
- Figs. 37-40. Various stages in the development of the embryo $\times 300$. Arrow points the direction of the neck of the archegonium.
- Figs. 41, 42. Sporogonia $\times 150$.
- Fig. 43. Rounding off of spore-mother-cell $\times 300$.
- Figs. 44-47. Spore tetrads and the development of the spore coats 44, 46 $\times 300$; 45, 47 $\times 200$.
- Fig. 48. Sporophyte showing sterile spore-mother-cells (St) in the midst of spore, tetrads (Sp). (W). Wall of the sporogonium. (T) thallus tissue of *Riccia* $\times 200$.

MITOSIS IN THE ANTHERIDIAL CELLS. (Figs. 49-78.)

- Figs. 49, 50. Resting nucleus $\times 1500$.
- Figs. 51-53. Early prophase $\times 1500$.
- Figs. 54, 55. Formation of chromosomes in early prophase $\times 1500$.
- Fig. 56. Late prophase chromosomes $\times 1500$.
- Figs. 57-61. Metaphase polar view showing 7 long and 1 small round chromosome $\times 1500$.
- Fig. 62. Metaphase spindle view $\times 1500$.
- Fig. 63. Early anaphase $\times 1500$.
- Figs. 64, 65. Anaphase showing the small chromosome preceding the larger ones $\times 1500$.
- Figs. 66, 67. Late anaphase $\times 1500$.
- Fig. 68. Telophase $\times 1500$.

- Fig. 69. Sperm-mother-cell showing structure. Note the dark granule at each pole $\times 2400$.
- Fig. 70. Same as above, with two granules, one at each pole $\times 2400$.
- Fig. 71. Metaphase with two granules, one at each pole $\times 2400$.
- Fig. 72. Spermatids with blepharoplast $\times 1500$.
- Fig. 73. Spermatid rounded off, showing the blepharoplast at one corner, nearby a vacuole $\times 1500$.
- Fig. 74. Stretching out of the blepharoplast $\times 1500$.
- Figs. 75-77. Elongation of the nucleus to form the body of the spermatozoid $\times 1500$.
- Fig. 78. Mature spermatozoid showing structure $\times 1500$.

SOMATIC MITOSIS. (Figs. 79-86.)

- Fig. 79. Resting nucleus $\times 1800$.
- Fig. 80. Late prophase $\times 1800$.
- Fig. 81. Metaphase $\times 1800$.
- Fig. 82. Metaphase spindle view $\times 1800$.
- Fig. 83. Early anaphase $\times 1800$.
- Fig. 84. Late anaphase $\times 1800$.
- Figs. 85, 86. Telophase $\times 1800$.

MEIOSIS. (Figs. 87-94.)

- Fig. 87. Leptotene $\times 1500$.
- Fig. 88. Zygotene $\times 1500$.
- Fig. 89. Synapsis $\times 1500$.
- Fig. 90. Diplotene $\times 1500$.
- Figs. 91, 92. Diakinesis $\times 1500$.
- Fig. 93. Metaphase showing 8 bivalents $\times 1500$.
- Fig. 94. Metaphase spindle view $\times 1500$.
- Fig. 95. Diplotene stage in the nucleus of the spore-mother-cell undergoing division. $\times 2000$.
- Figs. 96, 97. Photomicrographs of a nucleus at diakinesis stage in two foci showing bivalents. $\times 2000$.



Figs. 98, 99. Polar view of metaphase chromosomes in the antheridial cells $\times 2800$.

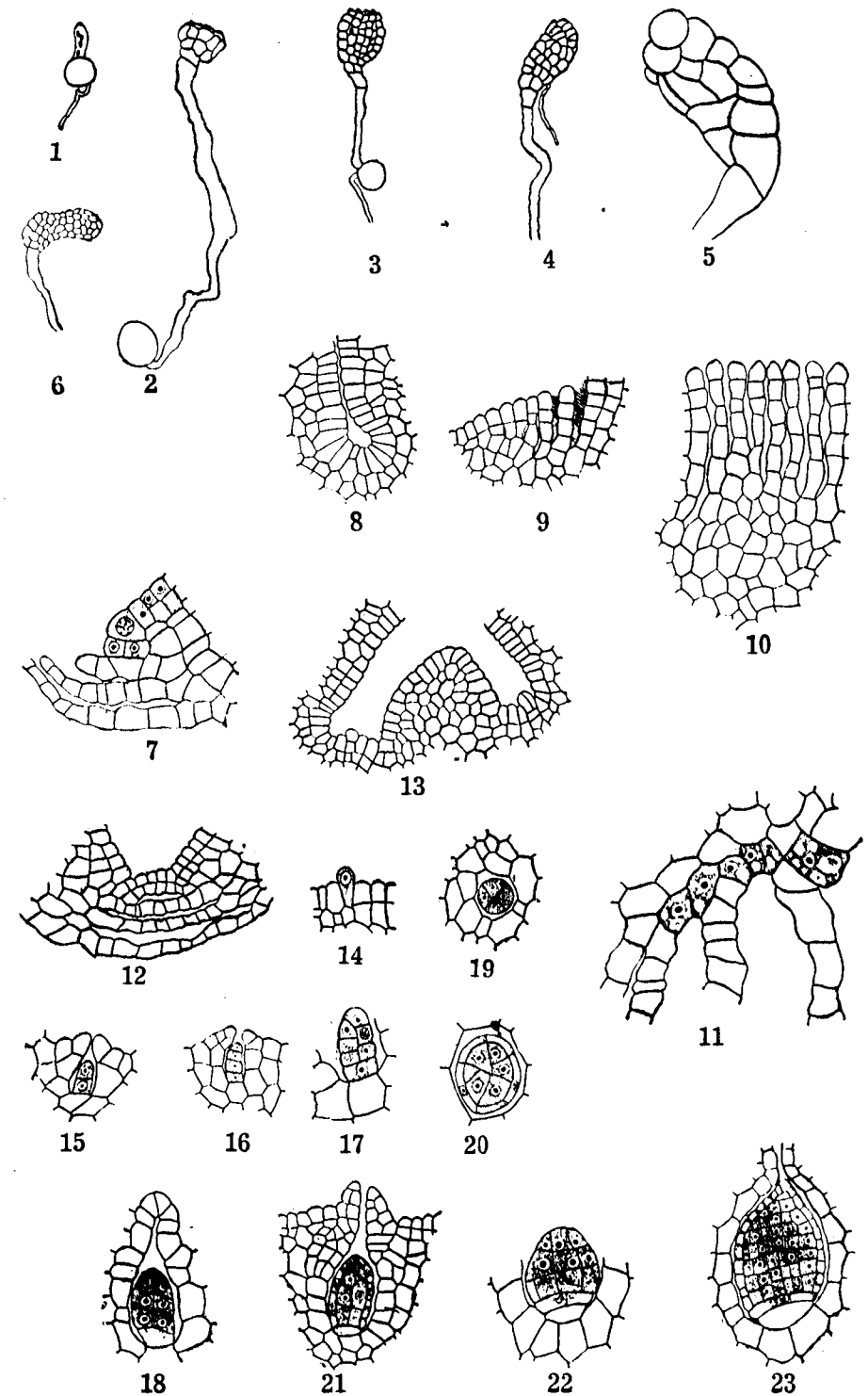
Fig. 100. Spermatid showing a dark granule at one end and a vacuole nearby $\times 2400$.

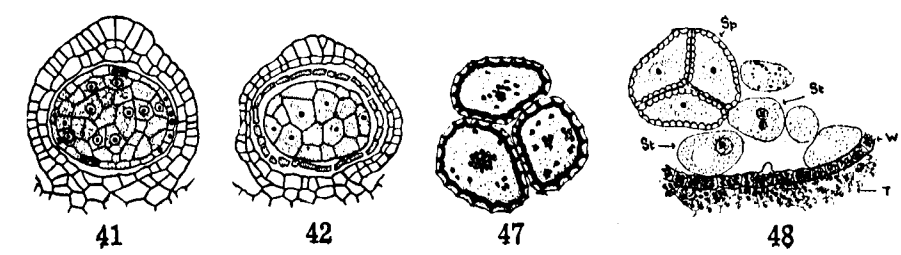
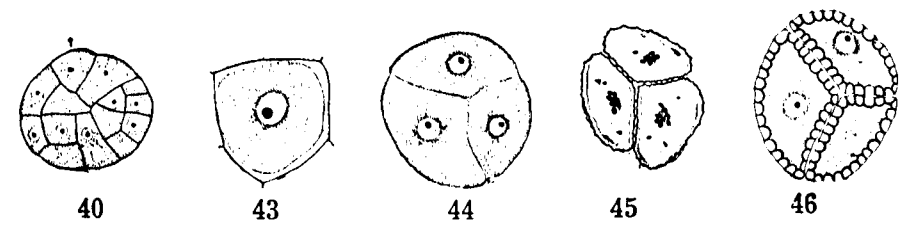
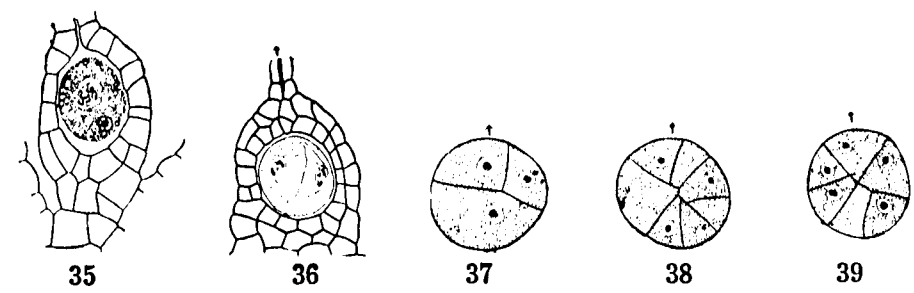
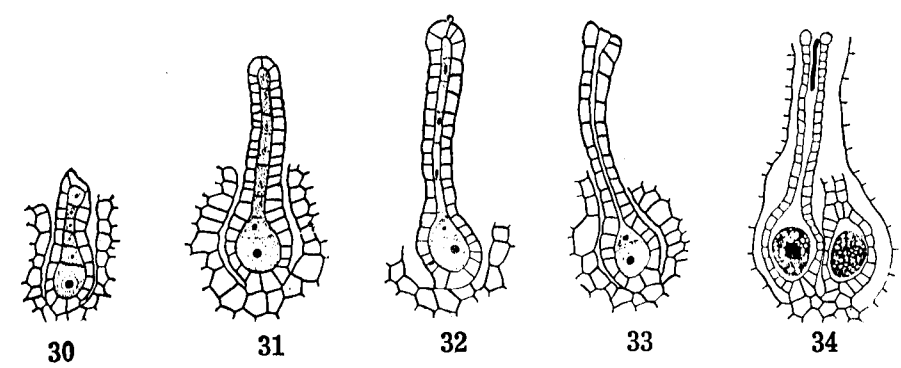
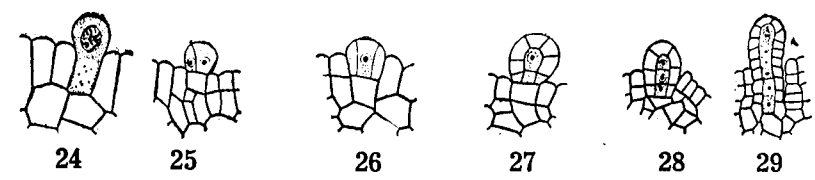
Fig. 101. Egg at fertilisation stage, showing the male and the female nuclei before fusion. $\times 500$.

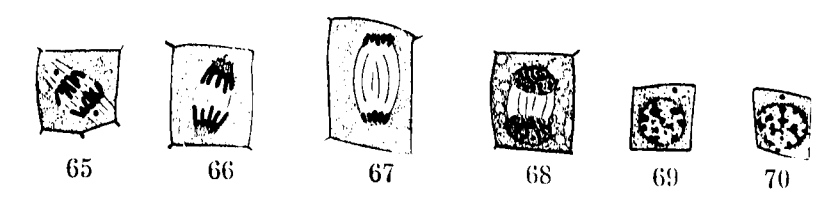
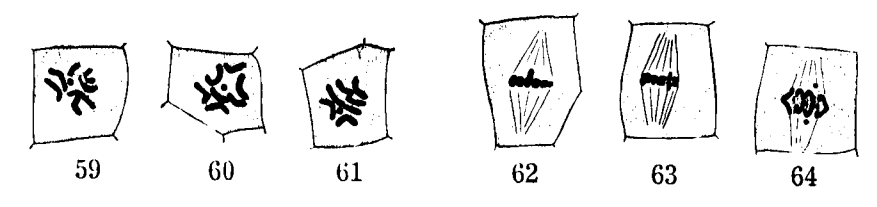
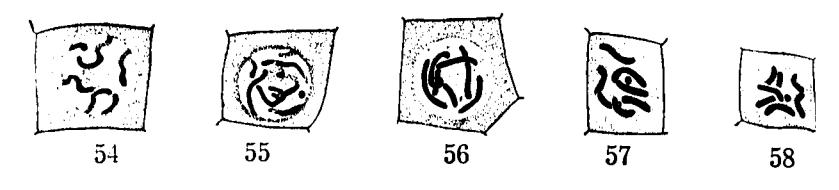
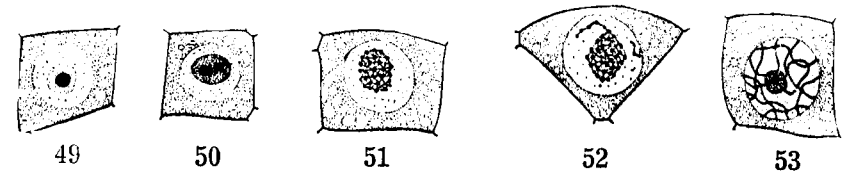
Fig. 102. Sporophyte showing sterile spore-mother-cells in the midst of spore-tetrads. $\times 240$.

Fig. 103. Egg at fertilisation stage, the male and the female nuclei fusing. Note the slender protoplasmic strands all about the egg. $\times 500$.

Fig. 104. Photograph of *Riccia himalayensis* st., showing habit. $\times 2$.









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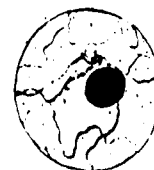
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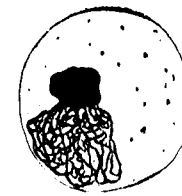
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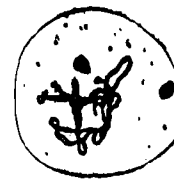
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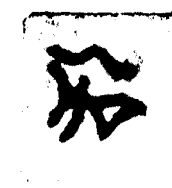
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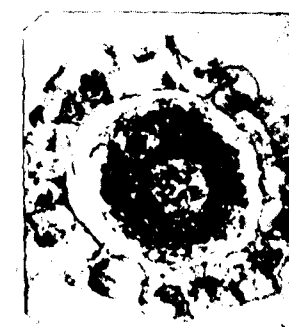
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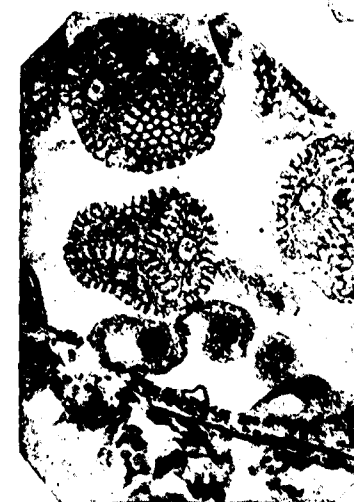
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103



NITROGEN PARTITION IN THE URINE OF SOUTH INDIANS^{*}

By

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The urinary nitrogenous excretion of human beings derives its significance from two facts, (i) that the daily excretion of nitrogen is an index of the nutritional level of the individual in regard to protein and (ii) that the marked variations from the normal in the quantities of some of the constituents arise only in pathological conditions.

Studies in the nitrogen partition in the urine of tropical populations have been carried out by a number of investigators. Campbell (1919) who investigated the urinary nitrogen output of different races attending the Medical School at Singapore found that the daily output per individual varied from 5 to 9 g. which is very much lower than the standard for Europe. Similar results were obtained by Concepcion (1918) who studied the nitrogen metabolism of the Philippine population of Manila.

In India McCay (1908) who carried out extensive nitrogen metabolism studies on Bengalis found that the average total nitrogen excreted by the Bengali was about 6 g. and concluded that "the ordinary standards of excretion of the urinary constituents for Europeans as stated in physiological text-books cannot be accepted for natives of Bengal and that therefore any deduction of a clinical or practical nature based upon these facts must be misleading". Much the same can be said for South Indians as the following results will show.

Hughes (1931) analysed the urine of thirty normal Punjabis and found that the average nitrogen excreted per diem by the Punjabi was slightly higher than McCay's standard for the Bengali, but considerably lower than the European standard. More recently Ray and Ganguly (1933) have studied the nitrogen partition in the urine of about fifty middle class Bengalis. The average values for total nitrogen and urea nitrogen were lower

^{*} First appeared as a note in "Current Science", 1933, IV, 96.

than that of McCay's standard, but the uric acid and creatinine output per diem, was shown to be nearly the same as that of Europeans.

The subjects of the present investigations were all males between the ages of 20 and 35, most of them being research students and the rest members of the department, and included both vegetarians and non-vegetarians. They were not subjected to rigid physical examination but were all pursuing their active everyday work and might properly be called normal individuals.

Rice formed the staple diet of both vegetarians and non-vegetarians. The vegetarian diet, besides rice, consisted of milk, vegetables, ghee, fruits, tea and coffee. The non-vegetarian diet contained in addition fish, eggs, poultry and mutton in moderate quantities.

The results of the analyses of 32 samples of normal South Indian urine are given in Table I. They include 14 vegetarians and 18 non-vegetarians. The total-nitrogen, urea-nitrogen and creatinine-nitrogen per kilogram body weight are given in Table II, the percentage of various nitrogenous constituents to the total nitrogen in Table III and a comparison of the average nitrogenous constituents of the urine of the South Indians with other known standards in Table IV.

Total Nitrogen

The total nitrogen excreted per diem by the South Indian varies from 4.1 to 11.1 g. This is slightly higher than the values found by McCay for Bengalis, and nearly the same as that given by Concepcion for the Philipinos, but is in striking contrast to the standard for Europe which is about 16 g.

Since the total nitrogen excreted in the urine is a measure of the total nitrogenous catabolism, the excretion of 7.1 g. of nitrogen by the South Indian corresponds to about 44 g. of protein catabolised. In the dietary studies of Aykroyd and Krishnan (1937) who investigated the diets of various villagers in South India it was found that the average protein intake per head was about 50 g.

The minimum protein requirement of the dietary is a matter on which there is no agreed scientific opinion. The uncertainty on this very important question is the result of various factors, the chief of which is that no definite knowledge exists as to the anabolism of protein in the animal organism; further the question is complicated by the fact that the nutritional value of protein is

determined by the presence of the essential amino acids. According to a recent review (Rose, 1936) the essential amino acids are lysine, tryptophane, histidine, phenylalanine, leucine, isoleucine, threonine, methionine, valine and arginine. Even on this question there is a considerable difference of opinion. Current views on the protein requirement in the dietary, are mainly based on two lines of evidence: (i) feeding experiments on adult human beings in which the minimum protein necessary for the maintenance of nitrogen balance has been determined; (ii) a comparison of the physique and health with actual protein consumption in different groups of individuals.

Based upon experiments of the first kind Chittenden (1904) and others have advocated a "low protein" diet containing about 45 g. of protein. On the other hand upon actual foodstuffs consumed in Germany, Voit (1881) proposed 118 g. of protein for an average man weighing 70 kilograms. Various other standards have been proposed from time to time. Atwater and Rubner (cited by Lusk) proposed about 125 g. of protein. McCay (1912) fixed the minimum at 100 g. Sherman (1920) from carefully controlled experiments and from exhaustive examination of the literature concludes that the protein requirement of man is about 0.5 g. per kilogram body weight per diem, and has proposed 1 g. as a standard which would ensure a sufficient margin of safety. According to the Nutrition Committee appointed by the British Medical Association (1933) 100 g. of protein are sufficient to maintain the health and activity of an average man. More recently the Health Committee of the League of Nations (1935) recommended that the protein intake for adults should not fall below 1 g. per kilogram body weight.

It is however doubtful if any definite conclusion can be arrived at on the basis of existing knowledge. There is no reason to believe that the minimum protein requirement for nitrogen equilibrium is also the optimum. The specific dynamic action of amino acids makes it probable that the raising of the metabolic level may be one of the functions of protein in the dietary. Further successful maintenance of health for short periods on a low protein diet may give no indication of the effect of such a diet continued for a life time. On the other hand conclusions based upon a correlation between deterioration of physique and health in any population suffering from protein inadequacy is also unsafe, because the low protein diet, as Aykroyd (1933) has pointed out, is likely to be deficient in other respects as well. At present it seems only possible to accept a value such as that fixed by the League of Nations

Health Committee, not so much because it is based upon sufficient scientific proof but because it strikes a mean between the two extreme views.

Urea

Urea, the chief end product of protein metabolism, is to a large extent exogenous in origin, and the changes observed in the amount of total nitrogen excreted per diem under different levels of protein intake are due to parallel variation in urea excretion (Folin 1905, Robison 1926). It is for this reason a more correct index of protein metabolised by an individual than the total nitrogen since the latter includes nitrogenous products which are assumed to be of endogenous origin also.

The Western standard for the excretion of urea is about 30 g. per diem and under ordinary conditions on a high protein diet the urea accounts for about 85% of the total nitrogen excreted. As the nitrogen excretion in the urine is made up of two factors, a constant endogenous catabolism dependant upon what Folin considered "tissue activity" and a variable exogenous catabolism determined by the intake of protein food, it is obvious that on a low protein diet not only the absolute amount of urea, but also the percentage of urea nitrogen to total nitrogen will decrease.

Urea values are also low in cases of diabetes accompanied by acidosis where some of the urea is transformed into ammonia for the neutralisation of acid. In acute yellow atrophy the ability of the liver to form urea is diminished and consequently the percentage of urea nitrogen to total nitrogen may fall to a very low level (Vanslyke and Stadie, 1920).

As shown in Table I urea values for South Indians vary between 6.4 to 19.4 g. the general average being 10.5 g. This is on a level with the standards already given for Bengalis and Philipinoes, but is only one-third of that for Europe. The percentage of urea nitrogen to total nitrogen varies from 44 to 88 in keeping with Folin's views stated above.

Ammonia

Ammonia is mostly exogenous in origin. The metabolic significance of ammonia is that it is produced in amounts which are necessary for the excretion of acids from the body (Keeton 1921, Gamble and Ross 1923). Since the end products of protein metabolism are mostly acid, the ammonia output varies in the same direction as the total nitrogen output though no definite relation

has been observed. On a low protein diet the percentage of ammonia nitrogen to total nitrogen increases provided the food is not such as to yield alkaline ash (Folin 1905, Robison 1926).

The average daily output of ammonia in the urine for Europeans and Americans is about 0.7 g. amounting to 2.5 to 4.5% of the total nitrogen excreted. The daily output for the South Indian varies from 0.308 to 0.982 g. (Table I) the general average being 0.588 g. But the ratio of ammonia nitrogen to total nitrogen which varies from 4.7 to 11.7% is higher.

Uric Acid

Uric acid represents the end product of the purine metabolism and owes its origin partly to purine substances of the food and partly to the metabolism of nucleo-proteins of the tissues.

A European adult on a mixed diet excretes, on an average, 0.7 g. of uric acid per diem. The general average for the South Indian is 0.483 g. The average values for non-vegetarians is higher than that of vegetarians. (Table V).

Creatinine

According to Folin (1905) the quantity of creatinine excreted per diem varies from 1 to 2 g., but for the same individual its output is a constant quantity, quite independent of the protein intake. This led Folin to conclude that creatinine is an "index or measure of the total normal tissue metabolism."

The average daily output of 1.35 g. of creatinine by the South Indian approaches the Western average of 1.55 g. The percentage of creatinine nitrogen to total nitrogen is higher in all cases than the Western standard, since creatinine being mainly of endogenous origin is not altered by the decrease in the total nitrogen output. The values obtained for the Bengali (Ray & Ganguly), Punjabi (Hughes), and Philipinoe (Concepcion) are nearly the same as that of the standard for Europe.

The "creatinine coefficient" which is defined as the creatinine nitrogen in mgm. excreted per kilogram body weight per diem was shown by Schaffer (1908) to vary between 7 and 11 for adult males and between 5 and 8 for women. According to Schaffer, the "creatinine coefficient" depends upon the muscular efficiency of the individual and therefore the value for a fat person will be lower than that of a lean man of like body weight. Hodgson and Lewis (1928) have recently shown that the differ-

ence in the "creatinine coefficient" between man and woman is not a sex characteristic, but is due to the low muscular development of women compared to men.

The general average of "creatinine coefficient" for the South Indian is 9.3 which is nearly the same as the standard for Europe. The significance of these results from the present point of view is that while the value for total nitrogen and urea nitrogen are low compared to Western standards and indicate a low level of protein ingestion, the endogenous metabolism which is little affected by the nutritional state of the individual and which might be expected to show a racial peculiarity is as measured by the "creatinine coefficient" not lower than that of Europeans and Americans. Attention may be drawn in passing to the difference in the averages for the "creatinine coefficients" of vegetarians and non-vegetarians. So far as this small difference is of any significance, it seems to be in keeping with the work of Abderhalden and Buadze (1930) and others who have demonstrated a slightly increased creatinine excretion in dogs after feeding certain amino-acids in massive doses and over a sufficiently long period.

As the creatinine coefficient is generally taken as an index of muscular efficiency, it is satisfactory to find that this factor cannot be correlated with the low basal metabolism of South Indians observed by Mason (1931). The views of the earlier investigators on basal metabolism may be summarised in the words of Lusk (1928): "On the basis of the whole of the evidence it does not appear wise to state that the influence of race or a tropical climate may greatly reduce the basal metabolism." Whether this is not, after all, the correct view and whether under-nutrition, such as is shown to exist in regard to proteins by the present study, is not a sufficient explanation for the low values for the basal metabolism of Indians obtained by Mason and others (Mukherjee and Gupta 1931, Sokhey 1927), can only be settled by carrying out basal metabolism and dietary studies simultaneously on groups of individuals at different levels of nutrition.

Experimental

24 hour samples of urine collected under toluene were used for analyses after ensuring by preliminary tests that each sample was free from protein and sugar.

Titrateable acidity was determined by titrating a known volume of urine with standard sodium hydroxide solution, using phenol-

phthalin as indicator, after adding potassium oxalate to precipitate the calcium salts.

For the determination of the other constituents the following standard methods were used:

<i>Total nitrogen.</i>	..	Micro Kjeldhal.
<i>Urea.</i>	..	Van Slyke & Cullen (1914).
<i>Ammonia.</i>	..	Folin & MacCallum (1912).
<i>Uric acid.</i>	..	Benedict & Franke (1922), Folin (1934).
<i>Creatinine.</i>	..	Folin (1914), Benedict & Folin (1929).

My thanks are due to Prof. M. Damodaran for the interest he has taken in this work.

TABLE I

No.	Body Wt. in Kilos.	Vol. in ml.	Acidity O.1 N. NaOH.	Specific Gravity	Total-N.	Urea	Urea-N.	NH ₃	NH ₃ -N.	Uric acid.	Uric acid nitrogen.	Creatinine.	Creatinine-N.	Undeter- mined-N.	Diet.
1	65.3	1460	354	1.019	8.12	13.06	6.10	0.478	0.408	0.483	0.161	2.12	0.787	0.671	Mixed
2	61.2	2154	225	1.012	9.86	15.78	7.36	0.711	0.586	0.740	0.247	1.33	0.545	1.125	
3	47.2	410	286	1.026	7.49	8.30	3.87	0.524	0.432	0.326	0.109	1.07	0.399	2.680	
4	52.4	1975	340	1.011	9.93	12.38	5.77	0.746	0.614	0.753	0.251	1.38	0.513	2.783	
5	63.4	2005	385	1.021	10.42	19.41	9.06	0.690	0.568	0.716	0.239	1.28	0.478	—	
6	47.6	706	254	1.022	5.99	10.20	4.75	0.437	0.386	0.333	0.111	1.33	0.494	0.267	
7	52.3	1540	310	1.015	6.72	6.47	3.02	0.503	0.414	0.438	0.145	1.02	0.381	2.780	
8	65.8	3764	410	1.007	8.43	11.15	5.21	0.810	0.667	0.607	0.202	1.85	0.685	1.673	
9	59.9	2783	286	1.010	11.11	17.03	7.95	0.982	0.809	0.854	0.285	1.59	0.592	1.476	
10	56.8	1335	348	1.014	8.89	14.60	6.81	0.541	0.445	0.401	0.134	1.17	0.433	1.066	
11	40.8	1474	273	1.012	6.32	10.64	4.96	0.352	0.290	0.334	0.111	1.37	0.508	0.449	
12	50.8	1050	347	1.016	8.27	8.56	3.99	0.494	0.407	0.438	0.146	1.27	0.470	3.252	
13	60.0	945	296	1.020	9.35	14.39	6.71	0.816	0.661	0.596	0.195	1.69	0.631	1.153	
14	52.0	1534	375	1.017	6.52	10.68	4.98	0.649	0.534	0.346	0.115	1.78	0.663	0.231	
15	53.0	1042	205	1.019	7.50	11.40	5.32	0.867	0.714	0.531	0.177	1.54	0.572	0.721	
16	50.9	1264	245	1.018	7.89	12.90	6.12	0.666	0.548	0.684	0.223	1.48	0.551	0.442	Vegetarian
17	40.4	1058	182	1.009	4.16	6.76	3.15	0.588	0.484	0.343	0.114	0.79	0.295	0.120	
18	59.5	1474	267	1.010	7.00	9.75	4.54	0.729	0.601	0.582	0.187	1.58	0.585	1.079	
19	58.7	1402	185	1.015	6.77	11.11	5.18	0.476	0.392	0.401	0.133	1.31	0.485	0.575	
20	53.0	1530	195	1.012	7.19	9.89	4.66	0.442	0.364	0.446	0.149	1.51	0.575	1.446	
21	59.0	1024	222	1.014	4.70	7.83	3.65	0.307	0.254	0.279	0.093	1.08	0.398	0.298	
22	60.0	2604	240	1.013	8.26	10.45	4.87	0.547	0.451	0.508	0.169	1.56	0.581	2.189	
23	92.5	1462	246	1.017	6.43	8.60	4.01	0.415	0.342	0.364	0.121	1.39	0.514	1.477	
24	59.9	1335	233	1.013	6.90	6.59	3.08	0.391	0.321	0.394	0.131	1.45	0.540	2.825	
25	50.0	624	175	1.023	4.11	6.74	3.14	0.370	0.304	0.260	0.187	0.95	0.355	0.218	
26	52.3	1032	241	1.015	5.21	6.74	3.15	0.427	0.351	0.216	0.072	1.18	0.439	1.203	
27	61.4	876	201	1.026	6.38	10.74	5.01	0.470	0.388	0.534	0.178	1.35	0.503	0.299	
28	56.8	886	180	1.021	7.38	8.62	4.02	0.953	0.785	0.742	0.158	1.01	0.373	2.062	
29	44.1	1215	244	1.020	6.06	10.04	4.68	0.625	0.515	0.571	0.190	1.51	0.562	0.112	
30	47.3	963	190	1.024	5.82	8.79	4.10	0.825	0.678	0.601	0.200	0.84	0.313	0.527	
31	45.5	875	167	1.023	5.99	8.40	3.92	0.539	0.455	0.327	0.109	0.87	0.325	1.190	
32	47.4	1250	156	1.013	5.74	8.97	4.18	0.616	0.507	0.401	0.133	1.46	0.513	0.376	

TABLE II

No.	Mgms. per kilogram body wt.		
	Total-N.	Urea-N.	Creatinine-N.
1	125	93	12.1
2	161	120	8.9
3	159	82	8.5
4	190	110	9.8
5	164	143	7.5
6	120	100	10.3
7	129	58	7.3
8	128	79	10.4
9	186	132	9.9
10	157	120	7.6
11	155	121	12.5
12	163	79	9.3
13	156	112	9.5
14	125	96	12.7
15	142	100	10.9
16	155	120	10.8
17	102	77	9.9
18	118	76	9.8
19	119	91	8.6
20	136	88	10.8
21	80	61	6.8
22	174	81	9.7
23	88	43	5.6
24	115	51	9.0
25	82	61	7.1
26	100	60	8.4
27	104	81	8.2
28	130	70	6.6
29	138	106	12.8
30	123	86	6.6
31	132	86	7.2
32	122	88	11.5
Average	132	89	9.3

TABLE III.

No.	% Total N.				
	Urea-N.	NH ₃ -N.	Ur/c acid-N.	Creatinine-N.	Undetermined-N
1	74.9	5.0	3.1	9.7	8.3
2	74.7	5.9	2.5	5.5	11.4
3	51.6	5.8	1.5	5.3	35.7
4	58.1	6.2	2.5	5.1	28.0
5	88.9	5.5	2.3	4.6	—
6	79.4	6.0	1.9	8.3	4.6
7	44.9	6.2	2.2	5.7	41.0
8	62.3	7.9	2.4	8.1	19.3
9	71.5	7.3	2.6	5.3	13.3
10	76.6	5.0	1.5	4.9	12.0
11	78.5	5.6	1.8	8.0	7.1
12	48.3	4.9	1.8	5.7	39.3
13	71.8	7.1	2.1	6.8	12.3
14	76.4	8.2	1.8	10.2	3.6
15	70.9	9.5	2.4	7.6	9.6
16	77.6	7.0	2.9	7.0	5.5
17	75.7	11.8	2.2	7.1	2.4
18	65.0	8.6	2.7	8.4	15.4
19	76.6	5.8	1.8	7.2	7.8
20	64.8	5.1	2.1	8.0	20.1
21	77.8	5.5	2.5	8.5	6.4
22	59.0	5.5	3.1	7.0	26.5
23	62.3	5.3	1.9	8.0	22.5
24	44.6	4.7	1.9	7.8	41.0
25	76.5	7.4	2.1	8.6	5.3
26	60.4	6.7	1.4	8.4	23.1
27	80.0	6.1	2.8	7.9	—
28	54.5	10.6	2.1	5.1	28.0
29	77.3	8.5	3.1	9.2	1.9
30	70.5	11.7	3.4	5.4	9.0
31	65.5	7.4	1.8	5.4	19.9
32	72.8	8.8	2.3	9.5	6.6

TABLE IV.
Comparison of the chemical constituents of the urine of South Indian with other known standards.

	Body Wt. in Kilos.	Vol. in ml.	Specific Gravity.	Total-N.	Urea.	Urea-N.	NH ₃ .	NH ₃ -N.	Uric acid.	Uric acid-N.	Creatinine.	Creati- nine-N.	Undeter- mined-N.
Europeans (Cole)	70	1440	1.020	16	30	14	0.60	0.50	0.7	0.23	1.55	0.58	0.70
Americans (Folin)	63.4	1430	1.022	16.8	31.6	14.7	0.60	0.50	0.54	0.18	1.55	0.58	0.85
Bengalees (McCay)	52	1200	1.013	6	13	6.0	—	—	0.45	0.15	—	—	—
Philippines (Concepcion)	51.4	935	1.019	7.1	9.6	4.5	0.64	0.53	0.38	0.13	1.481	0.55	1.27
South Indians	55	1400	1.016	7.1	10.5	4.9	0.59	0.49	0.48	0.16	1.349	0.49	1.04

TABLE V.

	Body Wt. in Kilos.	Vol. in ml.	Specific gravity.	Total-N.	Urea.	Urea-N.	NH ₃	NH ₃ -N.	Uric acid.	Uric acid-N.	Creatinine.	Creatinine-N.	Under- mined-N.	Creatinine coefficient (mgms.)
South Indian General	55.2	1386	1.016	7.10	10.54	4.92	0.538	0.485	0.483	0.161	1.349	0.495	1.045	9.27
South Indian Vegetarian	56.0	1554	1.018	6.20	9.21	4.30	0.533	0.439	0.413	0.138	1.276	0.464	0.860	8.48
South Indian Non-Vegetarian	54.4	1219	1.014	8.01	11.87	5.54	0.644	0.530	0.553	0.184	1.422	0.527	1.230	9.95

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INDIAN WALL PAINTINGS

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I. General.

Indian wall paintings¹ date from about the second century B.C. They are representative of the great days of the Andhra (2nd century B.C. to 2nd century A.D.), Vākāṭaka (4th to 5th century A.D.), Chāḷukya (6th to 8th century A.D.), Pallava (7th to 8th century A.D.), Rāshtrakūṭa (8th to 10th century A.D.), Chola (11th to 12th century A.D.), Vijayanagar (14th to 17th century A.D.), Moghul (from 16th century A.D.) and modern (from 17th century A.D.) periods in Indian history. This long period of two thousand years witnesses the vitality of Buddhism, when Buddhist art spread far and wide to the easternmost limits of Asia.

It is indeed a matter for regret that no attempt has been made so far to understand the technique² of Indian wall paintings. In spite of the stimulating studies of Chaptal,³ Davy,⁴ Berger,⁵ Raehl-

1. Though ancient Indian literature is full of references to Indian wall paintings, we limit our observations to extant examples of them.

2. The term "technique" is used here only in relation to the methods and materials employed by the artist. It is not used in the sense in which the artist employs it to connote brush strokes, which produce the necessary artistic illusions, and which exhibit the genius and personality of the artist or of the artistic world of his creation.

3. Annales de Chimie, 70, p. 22.

4. "Some Experiments and Observations on the Colours used in Painting by the Ancients." Phil. Trans., 1815, pp. 97-124.

5. Die Maltechnik des Altertums nach Quellen Funden, 2nd edn. (Munich: G. D. W. Callway, 1904).

mann,⁶ Laurie,⁷ Noël Heaton,⁸ and Eibner⁹ for reconstructing the painter's methods and materials in the West, nothing has been done in this direction for paintings in India. Some preliminary work has no doubt been done on Ajanta¹⁰ by Laurie, Sana Ullah and Hankin, but details of their investigations are not available. Prompted by a desire to give a scientific basis¹¹ for the proper understanding of the technique of Indian painting, the author undertook its chemical investigation.¹² There can be no doubt that a study of this nature will be useful to those who wish to follow the ancient painting processes in India or to improve upon them.

6. *Über die Maltechnik der Alten* (Berlin: George Reimer, 1910).

7. *Greek and Roman Methods of Painting* (Cambridge University Press, 1910).

Materials of the Painter's Craft in Europe and Egypt, (London and Edinburgh, 1910).

8. "The Mural Paintings at Knossos," *Jour. Royal Soc. of Arts*, 1910, 58, pp. 206-212.

"Minoan Lime Plaster and Fresco Painting," *Royal Inst. of Br. Architects*, 1911, 18, pp. 697-710, Third Series.

"On the Nature and Method of Execution of Specimens of Painted plaster from the Palace of Tiryns—Tiryns II," *Die Fresken des Palastes* (Athens, 1912).

9. *Entwicklung und Werkstoffe der Wandmalerei* (Munich: B. Heller, 1926).

10. Correspondence regarding the Preservation of fresco paintings in the Ajanta caves (for private circulation only).

11. Much of the technical processes of ancient painting remains unexplained, especially in India. If the artist is to achieve the technical skill and craftsmanship of the ancients and ensure the durability and permanence of his artistic creations, or to establish a firm foundation on which he may develop an individual style of his own, he must have a complete mastery of the painter's methods and materials. Without this basic understanding, the artist is only a slave of his materials or as Bocklin said, "adventurers as compared with the old masters and their sound traditions, whereby one stood on the shoulders of the other." When one considers how thoroughly Dürer, Leonardo, Rubens, Reynolds and other masters studied their materials, "one is tempted to smile at the fears of many modern painters who believe that their personalities would suffer if they should concern themselves too closely with the craftsmanship of their art." It is needless to point out that the wonderful craftsmanship of the past must for ever remain the solid foundation of art in India.

12. At the suggestion of Mr. J. F. Blakiston, formerly Director-General of Archaeology in India and of Rao Bahadur K. N. Dikshit, Director-General of Archaeology in India, the author undertook the chemical study of the Chola wall paintings (11th-12th century A.D.) in the Brihadisvara temple

Paintings from various sites dating from about the beginning of the Christian era down to about the 18th century A.D. have been investigated by the author. They are from the following well-known sites in India :

1. Ajanta (2nd century B.C.—7th century A.D.).¹³
2. Bāgh (7th century A.D.).¹⁴
3. Bādāmi (6th-7th century A.D.).¹⁵
4. Sittannavāsāl (7th century A.D.).¹⁶
5. Conjeevaram (7th century A.D.).¹⁷
6. Tanjore (11th-12th century A.D. & 17th century A.D.).¹⁸
7. Ellora (8th-12th century A.D.).¹³
8. Nārttāmalai (14th-15th century A.D.).¹⁹
9. Somapālayam and Lepākshi (15th-17th century A.D.).²⁰
10. Tirumalai (15th-16th century A.D.).²⁰
11. Cochin and Travancore (17th-18th century A.D.).²⁰

The wall paintings of the Muhammadan period in N. India have not been considered here for the reason that the immediate object of the author has been to investigate only those paintings whose technique is typically indigenous, without any admixture of foreign influence, Moghul or Persian.

These chemical investigations serve a number of purposes. They enable us (1) to reconstruct the technical processes of painting in ancient India, (2) to trace the development of Indian painting

at Tanjore, S. India. On the recommendation of the Director-General of Archaeology in India, and that of the Government of India, the author was invited by the Pudukkottai Durbar to preserve the wall paintings at Sittannavāsāl in which connection, he conducted chemical investigations on the technique of these paintings. Subsequently Mr. Blakiston collected materials from some of the other sites for purposes of chemical investigations. The Directors of Archaeology in Hyderabad, Gwalior, and Travancore, and the Superintendent of Archaeology in Cochin State helped the author with materials from the wall paintings in their respective states.

13. To be published in the Annual Report of the Hyderabad Archaeological Survey.

14. *Proc. Ind. Acad. Sci.* X, 2, 1939, pp. 85-95.

15. *Proc. Ind. Acad. Sci.* X, 3, 1939, pp. 145-49.

16. To be published in the Technical Studies, Harvard University.

17. *Proc. Ind. Acad. Sci.*, X, 2, 1939, pp. 77-84.

18. *Technical Studies*, IV, 4, 1937, pp. 221-240.

19. *Proc. Ind. Acad. Sci.* VII, 4, 1938, pp. 282-92.

20. In the course of publication.

technique, (3) to study the relationship between the technique of Indian and of foreign paintings in ancient times, (4) to study how far Indian texts on painting truly reflect the technique in actual practice in the past, and (5) to adopt proper scientific methods for cleaning and preserving such of those ancient wall paintings as are in immediate danger of extinction through a variety of causes.²¹ The first four problems will be discussed in the following sections.

II. Technique of painting in ancient India.

The details of the chemical investigations on the methods and materials of ancient Indian artists have been dealt with adequately in the various papers already referred to. As a result of these investigations, Indian wall paintings can be divided into the following four groups:

Group I:—Ajanta and Bāgh.

Group II:—Sittannavāsai, Conjeevaram, Tanjore Nārttāmalai, Bāgh, Lepākshi, Somapālayam, Tirumalai, Cochin and Travancore.

Group III:—Ellora.

Group IV:—Bādāmi.

This grouping is based on the preparation of the ground and on the binding medium employed.

Group I.

In the first group of paintings, the ground consists of two layers, one of *rough plaster* and the other of *fine plaster*. The *rough plaster* varies in thickness from 9.3 m.m. to 54.1 m.m. at Ajanta and from 7.8 m.m. to 20.9 m.m. at Bāgh. It has been applied to the walls and ceilings, to a thickness depending upon the inequalities of the surface. At Bāgh, the *rough plaster* is in two layers, the upper one being about 1 m.m. thick.

21. This is not, however, the place to discuss how scientific methods of cleaning and preservation depend upon the technique employed by the artist. For example, the methods of cleaning of the Sittannavāsai paintings will damage the Ajanta paintings, if adopted for them, for the former are frescoes, while the latter are tempera.

The *rough plaster* is of ferruginous earth containing a large proportion of clay, silica, vegetable fibres or paddy husks. The percentage of combined water and organic matter in the *rough plaster* varies from 5.91 to 14.11 at Ajanta and from 0.55 to 1.03 at Bāgh. In both the sites, the *rough plaster* does not contain any organic binding medium such as gup, glue, drying oil, albumin or casein. Hence the organic matter must be due mostly to vegetable fibres or paddy husks and to organic impurities present in the plaster. The consolidation of the plaster has, therefore, been brought about by the plasticity of clay²² and the vegetable fibres or paddy husks²³ present in it. At Ajanta these binding agents are present to a larger proportion than at Bāgh. Hence the plaster is firmer and better consolidated at Ajanta than at Bāgh.²⁴

The percentage of alkalies and sulphuric anhydride in the *rough plaster* is low. In other words, alkalies and gypsum, which give rise to efflorescence,²⁵ are negligible.

A smooth white coating of *fine plaster* of lime containing a trace of gypsum and fine particles of silica—the last two probably occurring as impurities—has been applied over the *rough plaster* to a thickness of 0.1 m.m. The *rough plaster* contains large grains of silica. Consequently the surface is rough and different parts of it would take the paint differently and thereby produce different optical effects.²⁶ The *fine plaster* therefore, evens out the surfaces to which it is applied and thus provides a uniform ground beneath the painting.

The *fine plaster* can be easily separated from the *rough plaster* thereby showing the absence of adequate binding between them. On the other hand, the extreme thinness of the paint film prevents it from being separated from the layer of *fine plaster*.

The *rough plaster* has not adhered well to the walls and ceilings.

22. Searle—The Chemistry & Physics of Clays and other ceramic materials (London: Ernest Benn, pp. 262-63.)

23. Encyclopaedia Britannica (14th edn.), Vol. 18, pp. 39-40.

24. Sir John Marshall & Others—The Bagh Caves in the Gwalior State (London: India Soc. 1927), pp. 16-17.

25. Max Doerner—The Materials of the Artist (London: Harrap, 1935), p. 272.

26. Thompson—The Materials of Mediaeval Painting (New Haven: Yale University Press, 1936), pp. 31, 40.

After the preparation of the ground, outlines were drawn and in the case of crude drawings probably by the method of pricking and pouncing.²⁷ The space between was then filled with colours.

The following pigments have been employed at Ajanta and Bāgh:—

Yellow and red ochres, carbon, lime, gypsum, terre verte and lapis lazuli.

Terre verte is found occurring in nature associated with rocks in and about the caves at Ajanta. Hankin has discovered also orpiment at Ajanta.²⁸

The pigments have been applied in tempera technique with animal glue as the binding medium.

Group II.

In the second group of paintings, the ground is in two layers, one of *rough plaster* and the other of *fine plaster* of lime. In the Kailāsanātha temple at Conjeevaram, however, some of the paintings have no plaster, but have, instead, lime wash alone for the ground.

The *rough plaster* of lime varies in thickness from 1.4 m.m. to 4 m.m. at Sittannavāsai, Conjeevaram, Tanjore, Vijayālaya Choliśvaram and from 1.7 m.m. to 5 m.m. at Bāgh and in some of the temples in Cochin. In the temples at Lepākshi and Somapālayam and in all the sites in Travancore, it varies from 3.5 m.m. to 12 m.m. With most of the specimens of *painted stuccoes* examined, it was difficult to separate the fine plaster from the layer of *rough plaster* or of the paint film. Thus there is good binding between the adjacent layers.

The principal components of the rough plaster are lime and sand, the latter serving as an inert material.²⁹ They have contributed to the consolidation of the plaster.³⁰ The *rough plaster* has few impurities. The very small percentage of iron and alumina

27. E. B. Havell, *Indian Sculpture and Paintings* (London: J. Murray, 1929), Appendix, p. 270.

28. Correspondence regarding the Preservation of Fresco paintings in Ajanta caves. (For private circulation only).

29. *Proc. Ind. Acad. Sci.*, VII, 1938, p. 286.

30. J. W. Mellor—*A Comprehensive Treatise on Inorganic and Theoretical Chemistry* (Longmans, Green & Co., 1923), III, p. 677.

in the plaster indicates the use of a rich lime having no hydraulic properties. Gypsum prevents the setting of the plaster. It gives rise to efflorescence, as the alkalies do. But their proportion is negligible.

The plaster has adhered well to the surface of the walls and ceilings, and has a fine gloss. There is no indication of any slaking on the ground. It is therefore evident that well slaked lime has been used in the preparation of the plaster. Some sort of pit lime has been used or special attention was paid to the proper slaking of lime and preparing it for fresco work.³¹ From the good preservation of the paintings, it is clear that the artists have taken the usual precautions against the wetness of sand or its open storage.³²

The *fine plaster* is mostly of lime containing fine particles of silica as impurity. It varies in thickness from 0.1 m.m. to 0.3 m.m. Such extreme thinness indicates that it is more a lime wash than a layer of lime plaster. At Tanjore, however, its thickness is about 0.6 m.m. and it resembles the *fine plaster* of Cretan and classical paintings in the West.³³

The ground appears very smooth. Evidently it has been polished with a trowel or a polishing stone.

In laying the pigments two technical processes are in evidence at these sites. Both of them are represented in the Chola and Vijayanagar sections of the paintings in the Brihadiśvara temple at Tanjore. The Chola section is exceptional in that the technique adopted is one of pure fresco. The pigments are interfused and often spread beneath the stucco surface. This is a characteristic of pure fresco such as is adopted in the Minoan paintings in ancient Crete. Further, fresco technique requires painting on wet lime ground before it dries up. When the ground is very thin it is liable to dry quickly. Consequently the technique requires a quickness and a sureness of hand.³⁴ These are evident at Tanjore.

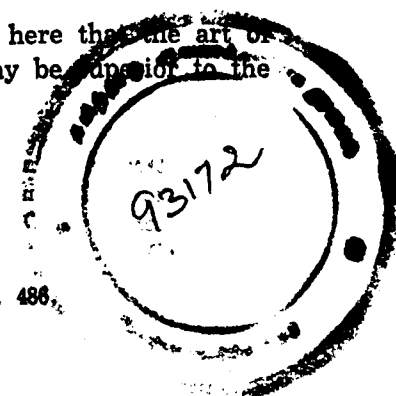
It may not be out of place to mention here that the art of Ajanta and Bāgh as judged by an artist may be superior to the

31. Max Doerner—*Loc. cit.*, pp. 268-69.

32. Max Doerner—*Loc. cit.*, pp. 270-71.

33. Noel Heaton—*Loc. cit.*

34. *Encyclopaedia Britannica*, 11th edn., XX, p. 486.



Chola art at Tanjore. But the craftsmanship of the former, as judged by the painter's methods and materials, are relatively crude when compared with that of the Cholas. In fact, in executing pure fresco,³⁵ Indian craftsmanship has reached its highest level of perfection.

Chola paintings are limited in number, being found only in the Brihadiśvara temple at Tanjore. We do not know the extent to which the fresco technique was followed by the Cholas.

It has been stated that the pigments in the Chola group of paintings at Tanjore have interfused and often spread beneath the stucco surface. In this respect, the *painted stucco* from the Vijayanagar paintings at Tanjore is somewhat different. Here the pigments are neatly superposed without any infiltration of the pigments into the plaster ground, and a section shows clean flat layers. At the same time, there is no other binding medium employed by the artist than lime. In other words, the pigments have been laid in *lime medium* or in *fresco-secco* technique.

The pigments employed in the second group of paintings are yellow and red ochres, carbon, lime and terre verte. At Sittannavāsāl and in the Chola site at Tanjore, lapis lazuli has been used. Evidently, pigments which were locally available and which were compatible with lime have been used.

The ground of lime plaster employed at Bāgh, Lepākshi and Somapālayam is not so well consolidated as in other sites. The *rough plaster* has been prepared by partially calcining limestone or by mixing with lime a large proportion of limestone to serve as an inert material.³⁶ No organic binding medium like drying oil, gum,

35. In a private communication to the author, Mr. Nandalal Bose, the eminent Indian artist writes as follows:—"The earliest example of what the Italians call fresco-buono are found in Fatepur Sikri Rajaputana is full of such frescoes, but Fatepur Sikri frescoes are the oldest It is such a sad story that no Indian literature about this technique is found. Some particulars have been published in "Indian Sculpture and Painting," Appendix, by Havell, but it is impossible to say anything about its origin. It seems it came to India from Persia, but we have no evidence to prove this." Though Indian literature is silent about the fresco technique, the 11th-12th century A.D. fresco-buono of Tanjore and the still earlier 7th century A.D. fresco-secco of Sittannavāsāl tell a different tale.

36. Technical Studies, V. (1936-37), p. 231.

glue, albumin or casein is present in the plaster, which therefore softens with water. Thus it is clear that the consolidation of the plaster has been brought about by a small percentage of lime and vegetable fibres present in it. It is unlikely that the lime plaster from Bāgh and the mud plaster referred to under Group I belong to the same period. The former represents a degenerate technique in *lime medium* of much later times, probably the result of stray influence from southern sites.

Group III.

Ellora which is the only representative of the third group of paintings, has combined the technique of Ajanta with that of Conjeevaram, Sittannavāsāl, Tanjore and other places in S. India. The ground consists of a layer of mud applied directly to the wall, with one, two or three layers of lime plaster thereon. The technique of preparing the former resembles that at Ajanta. But the preparation and laying of the lime plaster are typical of the S. Indian sites already referred to. The different layers of the plaster can be separated from one another with the help of a pin. Thus there is absence of adequate binding between them.

There is no good binding between the walls or ceilings and the mud plaster.

The thickness of the mud plaster varies from 3.6 m.m. to 11.3 m.m.; of the *rough plaster* of lime from 1.4 m.m. to 13.2 m.m.; the *fine plaster* from 0.3 m.m. to 0.5 m.m. and the paint film from 0.3 m.m. to 0.6 m.m. Such thick paint films betray a lack of delicacy in the artist's handling of the brush—a feature shared by some of the paintings at Lepākshi, Somapālayam and in Cochin and Travancore.

The lime plaster from Ellora is of poor quality and resembles that from Bāgh, Lepākshi and Somapālayam. But the former contains a larger proportion of vegetable fibres than the latter. They have been added purposely to consolidate it, especially when the lime is of poor quality. The consolidation of the mud plaster has been brought about by clay and vegetable fibres present in it.

The Ellora paintings have suffered much damage through ravages of time and weather and have almost disappeared. In many of the caves there are remnants of mud plaster without the superimposed lime plaster. It is not known whether these were covered with lime plaster and painted over in lime medium. It is equally difficult to ascertain whether they were painted in tempera on mud plaster as at Ajanta. Under these circumstances, the complete elucidation of the technique of Ellora paintings as it

was known in the past, is not possible. But typical specimens of still extant painted stuccoes indicate that the technique is one of lime medium.

Pigments from Ellora which have been available for analysis are the following:—

Yellow and red ochres, terre verte, carbon, lime and gypsum.

Group IV.

The only surviving examples of this group are the paintings at Bādāmi. The *rough plaster* at Bādāmi consists of a large proportion of clay and fine particles of silica mixed with animal glue and vegetable fibres. It varies in thickness from 0.4 m.m. to 0.6 m.m. Of the other components of the plaster, iron and lime occur only to the extent of 1.75% and 2.97% respectively, probably as impurities. The proportion of combined water and organic matter is 25.65%. The organic matter is partly vegetable fibres and partly animal glue, both being purposely added to serve as binding agents. The particles composing the *rough plaster* are so uniformly small and the surface so smooth that no fine plaster was considered necessary.

Speaking broadly and ignoring the presence of glue in the ground, one might say that the Bādāmi technique is a modification of Ajanta technique.

The following pigments have been used:—

Yellow and red ochres, carbon, lime and terre verte.

The pigments have been applied in tempera technique with animal glue as the binding medium.

III. Development of Painting Technique in Ancient India

There are two distinct styles of painting technique in ancient India. One of them is represented by Ajanta and Bāgh. At these sites, the ground has been prepared with a layer of *rough plaster* of mud, with a layer of *fine plaster* of lime thereon. Pigments were fixed with animal glue. In the absence of any other technique during this period, we may say that tempera paintings were common at Ajanta, Bāgh and elsewhere from the second century B.C. to the sixth century A.D., that is, for over eight centuries.

With the probable decadence and disappearance of the Ajanta art, there arose a second technique, which remained popular in S. India for over twelve centuries, that is, from the seventh century

to almost modern times. It is represented by the paintings at Sit-tannavāśal, Conjeevaram, Tanjore, and other places. Here the lime plaster has been employed for the ground, both as *rough plaster* and as *fine plaster*. The paintings have been executed in lime medium for the most part, but the Chola paintings at Tanjore are in pure fresco. It is evident that the artists have taken immense care in the choice of materials, in fact, more care than with Ajanta paintings. The technique is thus more perfect and enduring than that at Ajanta or Bāgh. We shall tentatively call the two styles of craftsmanship the northern and the southern.³⁷

The southern technique did not find its way into the north till the sixteenth century A.D. when it was adopted in the palace of Akbar at Fatepur Sikri and in Jaipur. The introduction of the fresco technique in Akbar's time might be due either to the Moghul and Persian influence or to influences from the south. But we have no evidence to show that the southern technique was popular in the north before the Moghul period. The Rāshtrakūṭas employed, no doubt, a poor form of it at Ellora. But we know of no other example of it in the north till we come to the Moghul period.

Just as the southern technique was not popular in the north, the northern technique was not popular in the south, unless the Sigiriya technique³⁸ could be proved to be one. Though northern technique did not find its way into the south—and we rule out Sigiriya for the present for lack of experimental data—it followed Buddhism and Buddhist culture and spread to centres outside India, to Bāmiyān³⁹ in Afghanistan and to Kizil⁴⁰ in Chinese Turkistan. If the northern technique spread to the south, it was evidently discarded in favour of the more permanent fresco technique.

37. The author originally intended to use the term "Ajanta" and "Sit-tannavāśal" styles as an alternative to the northern and the southern. But Dr. F. H. Gravely and Prof. K. A. Nilakanta Sastri prefer the latter terms as being more general, and they have been adopted here.

38. No scientific work has so far been conducted on the Sigiriya paintings. The author was unable to get materials from this site for analysis.

39. R. J. Gettens—The Materials of Wall Paintings of Bāmiyān, Afghanistan—Technical Studies, VI, 3, 1938. pp. 186-93.

40. R. J. Gettens—The Materials in the Wall Paintings from Kizil in Chinese Turkistan—Technical Studies, VI, 4, 1938, pp. 281-94.

A. von Le Coq, III, Die Buddhistische Spätantike in Mittelasien, III Die Wandmalerien (Berlin: Dietrich Reimer 1924).

This exclusiveness of the northern and the southern technique does not, however, mean that the south did not borrow the artistic style and the brush strokes of the north from Ajanta and Bāgh. But we are not concerned with this aspect here.

The Ellora technique probably represents a compromise between the southern and the northern schools, the southern elements predominating. We have here the mud plaster as at Ajanta and Bāgh, and lime plaster as at Sittannavāśal and Conjeevaram in the south. While the Ellora artist has employed the first coat of *rough plaster* in mud as at Ajanta, he has shown his preference for lime plaster in the final stages to paint on. But his efforts were rather crude. While the Ajanta artist has employed the tempera technique, the Ellora artist has painted in lime medium. The parallelism between the technique of Ajanta and that of Ellora is strictly confined to the preparation and laying of the mud plaster.

It has already been explained that the Bādāmi technique stands by itself. It is, therefore, difficult to say whether it was widely practised by Indian artists.

It is well known that in India, art developed under royal patronage. The credit for the earliest examples of Indian wall paintings goes to the Andhra kings whose artistic work is to be seen at Ajanta. When the Andhra kings held sway in the Deccan from about the second century B.C. to second century A.D., the northern technique first came into vogue. But craftsmanship generally presupposes a long period of training and probation before it can be assimilated to perfection. It is, therefore, likely that the northern technique arose long before the Andhras came to power, and that Ajanta is the last survival of a popular technique in the north. It might have been familiar under the Mauryan kings (326 B.C. to 185 B.C.) and even earlier and probably also in the Gupta empire. But since there are no paintings of this period in the north one cannot be too certain of it. But the similarity between the Ajanta and the Bāmiyān technique may be explained on the assumption that the northern technique was popular in northern India and that it imperceptibly crept into those distant regions. After the second century A.D. the Vākāṭaka kings continued the artistic traditions of the Andhras at Ajanta till about the 6th century A.D.

The southern technique could not have come into prominence by this time. If it had, the Andhras, whose sway extended to the south, would have been impressed by its superior merits and greater

permanence and adopted it at Ajanta in preference to the less permanent tempera technique on mud plaster.

The technique adopted at Bādāmi came into existence during the Chālukyan times (5th-6th century A.D.) Since it has not been adopted widely, it is perhaps foreign to the soil of India. It may be recalled that the influence of the Kushans (Indo-Scythians) and the Śakas was felt in the Deccan⁴¹ as early as the second century A.D. and even earlier. The Śakas were the subordinates of the Kushans and were drawn from Persia and Seistan. Thus, if any foreign influence could be attributed to the Bādāmi technique, it might have been from Persia or Seistan. But we cannot say anything more definitely till examples of paintings from these two countries have been thoroughly examined and their material analysed.

While the Andhras, the Vākāṭakas and the Chālukyas developed painting technique at Ajanta, Bāgh and Bādāmi from the second century B.C. to sixth century A.D., South India was experimenting with a new technique in painting. Under the patronage of the Pallava kings, Mahendravarman, Rājasimha and Paramēśvaravarman, a new painting technique was developed at Sittannavāśal and Conjeevaram and probably at other sites also for the first time in India. It came into vogue in the seventh century A.D. and enjoyed Pallava patronage for about a century. Since this technique is more difficult than the northern one, and the Pallava artists attained considerable proficiency in it, one is inclined to believe that sufficient time must have elapsed for the assimilation of this difficult technique. It is evident that the antiquity of the fresco technique must be traced to much earlier times. The Pallava tradition was followed by the Cholas (11-12th century A.D.) and the Vijayanagar kings (14th-16th century A.D.) and in the post-Vijayanagar paintings in and after the seventeenth century A.D. down to our own times.

In this connection it is interesting to note that under the Cholas, the technique of pure fresco was first introduced into Indian wall paintings. In the absence of more specimens of Chola paintings, it is difficult to say whether they adopted this tech-

41. "The second half of the third century 250-300 A.D. has been marked in the Deccan by the vast expansions of the Sakas of Ujjain." G. Jouveau Dubreuil—Foreword to Buddhist Remains in Andhra by Dr. K. R. Subramanyan. (Madras: Diocessan Press, 1932), p. ix.

nique exclusively, or even to trace the origin and development of fresco technique in India.

When the Rāshtrakūṭas came to power in the 8th century A.D. a new orientation was given to the northern and southern techniques. By this time, the Pallava paintings at Sittannavāśal and Conjeevaram had shown the beauty and strength of the fresco process. The Rāshtrakūṭas could not have been ignorant of it. But evidently they were unable to get away from the long established tradition of Ajanta, which was so near their seat of power. Thus they combined the northern and the southern techniques in the execution of the Ellora paintings in a manner which we have already described. Probably the southern technique was new to them and they could not grasp it thoroughly and adopt it to perfection. The lime plaster was ill prepared and lacks the firmness and strength of the Pallava plaster. There is no proper binding between the mud plaster and the walls and between the mud plaster and the lime plaster. This hybrid technique of the Rāshtrakūṭas persisted till about the twelfth century A.D. We do not know the extent to which this technique was popular. Unfortunately we have only scanty remains of the paintings at Ellora to judge by.

It is even possible that in the region of Ellora, the southern technique might have come into vogue before the time of the Rāshtrakūṭas, but subsequently degenerated just as their art did.

IV. Relationship between the technique of ancient Indian and foreign wall paintings.

The next problem is to determine the relationship between the technique of Indian and of foreign wall paintings in ancient times. In taking up this problem, we are by no means on sure ground. A serious handicap is the absence of wall paintings in countries like Greece at a time when she had direct contact with India. Even the North-West Frontier Province, the Punjab, the United Provinces and Bihar which had Greek influence after Alexander's invasion, have no wall paintings of this period. Further there is a lack of experimental data concerning the few wall paintings in the West, from countries like Greece, Asia Minor and Persia on the one hand and from China, Tibet and Japan on the other whose artistic traditions had contacts with the Indian.

We may, however, start with the early paintings in Bāmiyān in Afghanistan and Kizil in Chinese Turkestan, which summarise the vast problem of the importation of Indian technique into these distant regions and into the Far East. It has been shown already

that there is a similarity between the Ajanta and the Bāgh technique on the one hand and that of Bāmiyān and Kizil on the other.

What were the circumstances that led to the importation of Ajanta technique into these distant regions? It may be recalled that Buddhist religion and worship spread from India into Central Asia, China and the Far East ~~by~~ land. And Bāmiyān and Kizil, being strategically situated on the high roads of commerce from the classical world of the West and pilgrim's way to India and the East, was bound to be influenced by the art that came with the religion of Buddha. It is therefore but natural that in the 5th and 6th centuries A.D., the paintings at Bāmiyān and Kizil should betray influences from the dying cultures of the Roman Orient, Iran of the Sassanian period and a considerable influence of India proper. These elements are so harmoniously combined that frequently it becomes impossible to mention the predominance of any single foreign element. Thus it is not surprising to find that the technical traditions of Ajanta and Bāgh have influenced those of Bāmiyān and Kizil.

Though Bāmiyān and Kizil were subjected to classical influences and some of the paintings, especially in Chinese Turkestan, were the work of Roman artists,⁴² fresco technique which was common in the classical Western world is conspicuous by its absence. This is of great significance firstly in connection with the discovery of fresco technique in India and secondly in connection with the spread of the tempera technique from India into Afghanistan and Chinese Turkestan.

With the knowledge that tempera and fresco processes of painting were well known in India, we shall next proceed to trace the possible similarity and connection between the technique of Indian painting and that of the ancient civilisations. In this we shall adopt a chronological order whereby links, if any, will become more apparent. In taking up this problem, however, there are difficulties through lack of sufficient experimental data.

The most ancient civilisations which had cultural inter-relations and whose artistic records have come down to

42. Sir M. A. Stein—Serinda (London, 1929), p. 529.

Benjamin Rowland and others—The Wall Paintings of India, Central Asia and Ceylon, (Boston: Merrymount Press, 1938) p. 43.

us are the Mesopotamian, Egyptian and Indus Valley. Taking Mesopotamia first, the artistic history of the Sumerians extends from about 3500 B.C. to 2500 B.C. as revealed through the excavations at Erech, Ur, Nippur and ancient Lagash.⁴³ But there is no evidence of wall paintings.⁴⁴ Probably they have disappeared with the mud brick buildings which they ornamented, in which case they should have been done in tempera technique on weak mud plaster as at Ajanta. Frankfort⁴⁵ has, however, reported the presence of a lime kiln in the excavations of Khafage as well as lime plaster, but there is no evidence that this was painted over.

In the excavations of Eridu in ancient Babylonia, crude brick houses dating from 2300 B.C. have been covered with thick lime plaster. Horizontal bands of red and white and black pigments have been noticed, but nothing is known of their technique.⁴⁶ The Elamites, Hittites and Kassites, who succeeded the Babylonians, had no wall paintings. The Assyrians, however, had a few wall paintings of the 13th century B.C. at Kar-Tukulti-Enurta⁴⁷ and in the palace of Assurnasirpal at Nimrud. But of their technique nothing is known.

In ancient Egypt the Old Kingdom (3000-2500 B.C.) forms the golden age of art. There were also two minor renaissances, one in the Middle Kingdom (from 2000 B.C.), one in the New Kingdom (from 1300 B.C.), and a few others before the typical Egyptian art died under the Greek, Roman and Islamic domination. To mention a few of the sites, the tombs at Hierakonpolis,⁴⁸ the

Third Dynasty Tombs of Hesi-Re at Sakkara in the mastaba of Nefermet at Medum,⁴⁹ tombs of Beni Hasan,⁵⁰ etc., had paintings.

Egyptian wall paintings were often executed in tempera on a ground of mud plaster as at Ajanta.⁵¹ Later paintings reveal the presence of gypsum ground combined with lime. This technique, however, has not been met with in India. In the New Kingdom, lime plaster has generally been used in two coats placed above a rough layer of coarsely ground limestone, 1.3 c.m. to 2.6 c.m. thick. But the technique was in tempera.

The pigments⁵² employed in the Fifth Dynasty paintings (2750 B.C.) were charcoal, lime, Egyptian blue, yellow red and brown ochres. The ochres, charcoal and lime, were common to Indian paintings. Later on the pigments increased to sixteen. They were probably mixed with gum arabic, albumin, size or honey.

The distance of time that separates Ajanta from Egypt is so great, and the Greek, Roman and Hellenistic civilisations that followed the latter adopted fresco technique to the exclusion of the tempera to such an extent, that it is difficult to speak of any Egyptian influence on Ajanta technique.

The next civilisation which we encounter is that of the Indus Valley dating from about 3250-2250 B.C. There are examples of mud plaster as at Ajanta and of gypsum plaster,⁵³ but there is no trace of painting. If the weak mud plaster was painted over in tempera as at Ajanta, the paintings have disappeared with the ground.

43. E. de Sarzec and L. Heuzey—*Découvertes en Chaldée*, Paris, 1884-1912.
L. Heuzey—*Catalogue des antiquités chaldéennes* Paris, 1902;
L. Heuzey & E. de Sarzec, *Une Villa royale chaldéenne vers l'an 4000 avant notre ère*, Paris, 1900.
Cross, L. Heuzey and F. Thureau-Dagin,—*Nouvelles fouilles de Tello*, Paris, 1910.
H. R. Hall—*J. E. A.*, VIII (1912), pp. 241-57.
44. Mary Hamilton Swindler—*Ancient Painting* (New Haven: Yale University Press, 1929) p. 47.
45. Tell Asmar and Khafage, 1930-31, p. 90.
46. Swindler—*Loc. cit.* p. 58.
47. Swindler—*Loc. cit.* p. 58.
W. Andrae—*Coloured ceramics from Ashur*, London, 1925.
A. H. Layard.
48. J. E. Quibell, F. W. Green—*Hierakonpolis II* (1902).

49. J. E. Quibell, *Excavations at Saqqara* (1911-12) Le Caire, 1913.
50. W. Spiegelberg, *Geschichte der ägyptischen Kunst*, Leipzig, 1903, p. 22.
51. Prisse d' Avennes, *Histoire de l'art égyptien*, Paris, 1878.
A. Eibner, *Entwicklung und Werkstoffe der Wandmalerei vom Altertum bis Neuzeit*, München, 1926.
A. P. Laurie—*Greek and Roman Methods of Painting*, p. 107.
A. P. Laurie—*Materials of the Painter's craft in Europe and Egypt*, 21ff.
52. Swindler—*Loc. cit.* p. 40.
A. P. Laurie, W. F. Mc Lintock, F. D. Miles, *Proc. Roy. Soc.*, Vol. 89, pp. 418-429.
W. M. F. Petrie—*Ancient Egypt*, I, 1914, p. 186.
53. E. J. H. Mackay—*Further Excavations at Mohenjo-Daro* (Delhi: Government of India Press), Vol. I (1938), p. 162.

The earliest civilisation exhibiting a remarkable skill in painting technique is the Cretan⁵⁴ and the Aegean.⁵⁵ The paintings occur in the palace of Minos at Knossos on the northern coast of Crete and in Phaestos and Hagia Triada on the southern coast. They belong to the Middle Minoan II-III (1900-1580 B.C.), though perfection in art is attained in the Middle Minoan III—Late Minoan I (1580-1458 B.C.).

Some of the early Cretan buildings of Vasiliki dating from Early Minoan I-II (3400-2400 B.C.) are of rubble and sun-dried bricks with lime stucco thereon to a thickness of about 5 c.m. But from the Middle Minoan II—Late Minoan I (1900-1450 B.C.), the Cretan painter seems to have devoted greater attention to the preparation of the ground.

The Cretan technique has been clearly brought out in a number of important papers.⁵⁶ The artists have made use of lime plaster containing 40% of lime and the rest clay. Later on the plaster became richer in lime and contained 94% of it. The plaster was in two layers and in the best examples, the upper layer was a fine plaster of lime, both together being about 2 c.m. thick. In this respect the preparation of the plaster ground resembles that in the southern technique in India.

When the plaster was placed on gypsum, it was usually from 1.5 mm. to 12 mm. thick. In some cases, the ground was a mere lime wash as in the case of some of the paintings in the Kailāsanātha temple at Conjeevaram.

The Cretan frescoes are porcelain-like in appearance testifying to the fine preparation of the materials. This is to be expected in a pure fresco technique such as is adopted here. The plaster was probably put on in sections lest it should dry out before the completion of the work. In other words, the artist has exhibited a quickness and a sureness of hand in the execution of the paintings. The same qualities are evident in the Chola paintings at Tanjore.

The pigments that have been used are as follows:—Lime, shale, slate, impure carbon, yellow and red ochres, Egyptian blue

54. Sir Arthur Evans—*The Palace of Minos at Knossos*, I, (London: Macmillan & Co) pp. 524-551.

55. G. Rodenwaldt—*Der Fries des Megarons von Mykenai*, Halle, 1921. Swindler—Loc. cit. pp. 71-108.

56. Noël Heaton—Loc. cit.

and Egyptian green. Except the Egyptian blue and the green, shale and the slate, the other pigments are common to Indian paintings.

The Cretan technique is represented on the mainland of Greece by the frescoes from Thebes and from the earlier palace at Tiryns dating from Late Helladic I-II (1600—1400 B.C.) and in the later palaces of Tiryns and Mycenae dating from Late Helladic III (1400—1100 B.C.). The technique is the same as that of the Cretans, though relatively degenerate.

The Cretan paintings are of special interest to us as being the earliest examples of a technique which closely resembles the Chola one at Tanjore. In the fresco-secco form, it is quite common in South India.

The inroads of foreigners, especially the Achaeans and the Dorians put an end to the Cretan-Mycenaean supremacy by 1100 B.C. Many of the Aegeans were then driven to the neighbouring islands and to the shores of Asia Minor. Perhaps the Cretan artists and their artistic traditions spread farther east from the shores of Asia Minor into the interior, probably as far as Persia and India.

If we turn to Greece from 1100 B.C. to the point where we left the Mycenaean civilisation with the invasion of Dorians, we find a dark age ensuing. It is not until the 6th century B.C. that the art of painting comes to the fore once more in Greece. We shall, therefore, turn our attention to Etruria and S. Italy, which started with well-established artistic traditions, almost contemporaneously with the second phase of Greek art, which began from about the 6th Century B.C.

According to Herodotus, Horace and other writers⁵⁷ the Etruscans were in essence Asiatic and came to Italy from Lydia. Probably as early as the 8th century B.C. they were occupying the various parts of Italy and in the 7th and 6th centuries B.C. were

57. Hdt., I, 94.

Hor., Sat., I, 6, 1.

Hor., Odes, III, 29, 1.

Recent research among Italian scholars seem to favour an autochthonous origin for the Etruscans. Cf. L. Pareti, *Le Origini etrusche*, Firenze, 1928.

For an eastern origin, see D. Randall MacIver, *The Etruscans*, Oxford, 1927.

ruling over Rome. The Etruscan paintings dating from the 7th century B.C. can still be seen in their tombs.⁵⁸

They are usually considered to be true frescoes⁵⁹ executed on lime plaster about 1 c.m. thick. The walls of Etruscan tombs are wet and have remained so for centuries. This has enabled the fresco process to be employed even on a thin layer of lime plaster as at Corneto, Chiusi, Veii, Vulci and other sites, for the wall would always remain wet so that the fresco process could be carried on with leisure and care. Further, on account of this wetness, tempera technique would have been out of the question.

According to Duell,⁶⁰ Tomba del Barone was painted in lime medium.

The pigments that were employed by the Etruscan artists are as follows:—Earth colours, Egyptian blue, carbon black, and a mixture of yellow ochre and Egyptian blue for the green. Of the pigments, the earth colours and the carbon black are common to Indian paintings.

The Etruscan technique which dates from the 7th century B.C. to the 2nd century B.C. is probably an offshoot of the Cretan and the Mycenaean, and resembles the southern technique in India.

58. Swindler—Loc. cit. pp. 237-264.

Poulsen—Etruscan Tomb Paintings, their subjects and significance (Oxford, 1922).

F. Weege—Etruskische Malerei, Halle, 1921.

C. C. Van Essen—Did Orphic influence on Etruscan paintings exist? Amsterdam, 1927.

L. Canina, L'antica città di Veii, Roma, 1847.

J. Marthas, L'Art étrusque, Paris, 1889.

F. von Stryk, Studien über die etruskischen Kammergräber, Dorpat, 1910.

T. L. Seeman, Die Kunst der Etrusker, Dresden, 1890.

A. Rumpf—Die Wandmalereien in Veii, Leipzig, 1915.

59. O. Donner von Richter, in W. Heilbig, Wandgemälde Campaniens, 1868, Einl.;

Technische Mitth. für Malerei, Sept. 1903.

G. Perrot and C. Chipiez, Histoire de l'art, IX, 208.

F. Weege, Loc. cit. Ch. VII.

E. Berger, Maltechnik des Altertums, 1904.

E. Raehlmann, Über die Maltechnik der Alten, Berlin, 1910.

Donner—Bulletino dell'Inst. di Corrispondenza arch., 1869, pp. 201 ff (Etruria).

60. Mem. of the Amer. Acad. in Rome, VI (1927).

During the 5th and the 4th centuries B.C. when the Etruscan power was waning, the Oscans of S. Italy⁶¹ came into prominence. Their tomb paintings from Capua, Nola, Paestum, Cumae, etc., are in *pure fresco* technique, and are executed on lime plaster 4 c.m. thick. The pigments are the same as those employed by the Etruscans. The Oscan technique is, therefore, a descendant of the Etruscan technique.

We have already stated that a dark age ensued in the history of Greek art after 1100 B.C., which continued to about the 6th century B.C., and even later. Classical literature is full of reference to ancient artists like Apelles, Zeuxis and Polygnotos and others of this period. But unfortunately their wall paintings have been lost to the world.⁶² We have only indirect evidence of them from their painted pottery. It is therefore not possible to speak of the technique of the Greek wall paintings with certainty.

From about the 3rd century B.C. which may be described as the beginning of the Hellenistic Age, the centre of painting was no longer Greece, but shifted to other countries. Evidences of the Hellenistic paintings are seen from the decorations of houses at Pergamon,⁶³ Priene,⁶⁴ Delos,⁶⁵ Thera,⁶⁶ Pompeii,⁶⁷ etc. Of these the Pompeiian paintings form an important group having a family resemblance with the rest. Certain examples of Hellenistic paintings in Palestine reveal Greek influence with the admixture of oriental elements. Of special interest are the Hellenistic Tomb paintings from Marissa,⁶⁸ dating from the 3rd to 2nd century B.C. which have in them Greek and eastern elements. But such evidences of the Hellenistic paintings are fragmentary.

61. F. Weege: Oskische Grabmalerei, Jahr., 24 (1909) W. Annali dell' Instituto, 37 (1865) pp. 282-88.

62. Swindler—Loc. cit., p. 109.

63. W. Dörpfeld—Gesimse unter Wandmalereien—Ath. Mitth., m. 36 (1911).

64. T. Wiegand and H. Schrader—Priene, Berlin, 1904.

65. M. Bulard—Peintures murales et Mosaïques de Delos, Mon Piot, XIV, 1908.

66. Hiller von Gartringen, Thera, III, 145, 148.

67. K. Boissier, Rome and Pompeii, N. Y., 1905.

W. Heilbig, Wandgemälde der vom Vesuv verschütteten Städte Campaniens, Leipzig, 1868.

For other treatises, see Bibliography in Swindler's "Ancient Painting."

68. Peters and Thiersch—Painted Tombs in the Necropolis of Marissa, London 1905, (Palestine Explor. Fund).

We know very little of the technique of these paintings. Since the Pompeian paintings are the last vestiges of Hellenistic paintings, one may presume that the technique of the former reflects that of the latter. Thus Pergamon, Priene, Delos, Thera and Marissa, probably exhibit the Pompeian technique.

The Pompeian wall paintings are in fresco or in fresco-secco technique with occasional touches in tempera.⁶⁹ The underlayers of colours are in fresco, while the upper ones are in tempera. The yellows and the reds, which are earth colours, and the black which is carbon, are in fresco. These pigments are superimposed by others, such as the Egyptian blue and the green, which are incompatible with lime and some reds, which are earth colours. Albumin, or glue have probably been used as binding medium in the tempera process.⁷⁰

Excepting the earth colours and the carbon, none of the other pigments have been used in Indian sites. The fresco technique in Pompeii resembles the southern technique in India except that the Pompeian plaster is much thicker than the Indian.

Roman paintings from the 3rd century B.C. to the 1st century A.D. continued the Hellenistic Greek, Italic and Etruscan traditions in style. In technique also there was probably the same similarity. The paintings of the Augustan Age from the Columbarium of the Villa Pampila,⁷¹ Villa of Cicero,⁷² Pompeii,⁷³ the paintings of the Julio-Claudian era, paintings of the times of Tiberius,⁷⁴ Nero,⁷⁵ Hadrian, Marcus Aurelius and others, are probably in fresco similar to southern technique.

An important centre for paintings of this period is Dura-Salhiyeh⁷⁶ in Syria, the last Roman outpost established after

69. Donner, Berger, Raehlmann, Laurie.

70. Swindler—Loc. cit., p. 422.

71. E. Samter "Le Pitture parietali del Columbario di Villa Pamfili," *Rom. Mitth.*, VIII (1893), pp. 105-144.

72. Swindler—Loc. cit., pp. 369-70.

73. A. Ippel, *Der dritte pompeianische Stil*, Berlin, 1910.

74. Thomas Ashby—*The Columbarium of Pomponius Hylas* B. S. R., V., 1910, pp. 463 ff.

75. F. Weege, *Das Goldene Haus de Nero*, Jahr 28, 1913, pp. 127 ff.

R. Lanciani, *The Ruins and Excavations of Ancient Rome*, N.Y. 1897.

76. J. H. Breasted—*Peintures d'époque romaine dans le désert Syrie—Syria* III, 1922, pp. 177 ff.

Oriental Forerunners of Byzantine Painting, Vol. I, (Publ. of the Orient. Inst. University of Chicago, 1924.

Clermont—Ganneau, F. Cumont, "Les Fouilles de Salhiyeh sur

Mesopotamia became a Roman province in 114 A.D. It became an important station on the route from Antioch eastward to Seleucia on the Tigris. These are the last examples of Graeco-Syrian paintings revealing Hellenistic style, and probably also Hellenistic technique. We do not know whether the Hellenistic technical traditions were carried farther east to Persia and India.

The next group of paintings that we come across are those in the Christian catacombs. According to Eibner,⁷⁷ they are in fresco or fresco-secco.

In concluding this section, it may be stated that in their paintings, if any, the Sumerians and the Babylonians (3000-1300 B.C.) adopted probably tempera technique and a little of fresco. But there are no reliable data regarding them. Egypt (3000-1370 B.C.) invariably adopted tempera technique in its wall paintings. There is no evidence of painting in the Indus Valley (3000-1370 B.C.). Crete and Mycenae (1700-1100 B.C.) Etruria and S. Italy (7th-4th century B.C.), Pompeii (4th century B.C.-1st century A.D.) and the Christian catacombs adopted fresco technique with occasional touches in tempera at Pompeii. It is not unlikely that the Pompeian technique is but Greek and Hellenistic technique. Thus the latter civilisations were greatly impressed by the technical excellence of the Cretan and the Mycenaean paintings and hence adopted the superior fresco technique to the exclusion of the tempera, which was popular only in Egypt. In other words, the tempera technique almost ceased to exist with the disintegration of the Egyptian civilisation.

Thus there is a continuous tradition in the art of fresco painting in the West from about 1700 B.C. to about the 3rd century A.D. These traditions have probably been carried into Asia Minor and the last Roman outpost of Dura-Salhiyeh in Syria. Thus the fresco enjoyed a much wider popularity in the West than the tempera, which was limited mostly to Egypt.

We may now continue the story of Indian painting.

In India, the northern technique resembles the Egyptian tempera technique, and is strictly limited to Ajanta and Bâgh. There

l'Euphrate," *Syrie*, IV (1923), pp. 38. *Fouilles de Doura-Europos*, Paris. 1926. E. Diez, *Belvedere* (1924-25) finds evidence of Far Eastern influence in the paintings.

77. Loc. cit.

is no reason to presume that the Ajanta technique was indebted to the Egyptian, for after the disappearance of the Egyptian civilisation, the tempera technique of Egypt was superseded by the fresco technique in the West from 1700 B.C. to about the 3rd century A.D. Thus there is a break of several centuries between the disappearance of the tempera technique and the rise of fresco technique in the West. In other words, at the time the Ajanta paintings were executed, the West practised only the fresco technique to the exclusion of the tempera. With a break of several centuries between the disappearance of the tempera and the rise of fresco in the West, one is not justified in assuming that there was any Egyptian influence on Ajanta and Bāgh technique.

The southern technique was practised in many places in S. India. This must be due to its superior merits. The fresco almost ceased to exist in the Western world by about the beginning of the Christian era, and we hear nothing of it till we come to the time of Michael Angelo and others in the 16th century A.D. But we find the fresco technique for the first time at Sittannavāsāl in S. India even as early as the 7th century A.D. If we assume for a moment that the Indian fresco was indebted to the Western, there are serious difficulties. Firstly, there is a difference of about six centuries from the time when the West almost ceased to produce it to the time when India took it up. Secondly, Bāmiyān and Kizil, which were subjected to classical influences from the West, and were situated on the trade route from the West, show no signs of this technique. And fresco technique could not have been imported into India without influencing Bāmiyān and Kizil. But it is certain that, with the disappearance of the Egyptian tempera technique and the temporary disappearance of the fresco technique in the West from about the beginning of the Christian era down to the Middle Ages, it was the northern technique or the technique adopted at Ajanta that spread to Bāmiyān and Kizil and probably to countries in the west and the east. From our enquiry it is very difficult to speak of the foreign origin of Indian fresco technique, or to estimate the extent of India's indebtedness, if any, to the painting technique of the classical Western world. There is a greater need to-day than ever before to undertake systematic scientific investigations on wall paintings from Asia Minor, Persia, Afghanistan, Tibet, Chinese Turkestan, China and Japan—countries which had direct or indirect cultural contacts with India—before this problem can be solved.

Starting with India, Bāmiyān and Kizil, which had direct cultural contacts with one another, the results of the preceding pages might be put down in a tabular form thus:—

Civilisation.	Date.	Ground.	Pigment.	Binding Medium.	Remarks.
Indian	2nd C. B.C. to 6th C. A.D.	1. Ferruginous earth & vegetable fibres. 2. Clay & vegetable Fibres.	Ochres Terre verte Lime Gypsum Lapis lazuli.	Glue. Gum.	
	7th C. A.D. to 18th C. A.D.	3. Lime & Sand.	„	Lime	
Kizil	5th-8th C. A.D.	Clay gypsum vegetable fibres.	Copper silicate Ultramarine Red ochre Red lead gypsum	Glue.	
Bamiyan	„	„	Ultramarine Charcoal Red lead Red ochre yellow ochre Green? gypsum	Glue.	
Mesopotamian	3000-1300 B.C.	1. Mud? 2. Lime plaster?	?	?	No investigation has been carried out.
Egyptian	3000-2500 B.C. from 2000 B.C. from 1370 B.C.	Mud Unburnt gypsum Gypsum & lime. Lime Plaster	Charcoal Lime Egyptian blue Egyptian green Ochres.	Gum Albumin Size	Binding Medium not definitely known.

Civilisation.	Date.	Ground.	Pigment.	Binding Medium.	Remarks.
Indus Valley	3250-2250 B.C.	Mud ? Gypsum ?	?	?	No paintings known
Cretan	1750-1450 B.C.	Lime Plaster Gypsum plaster Lime & gypsum plaster	Lime Shale Slate Carbon Ochres Egyptian blue & green	Lime	First example of pure fresco.
Mycenaean	1600-1100 B.C.	"	"	"	Fresco
Ancient Greece.	1100-600 B.C.	?	?	?	No example of actual wall paintings
Etruria	8th-2nd C. B.C.	Lime Plaster	Ochres Egyptian blue Carbon black	Lime	1. Fresco 2. Fresco secco
Oscan	5th-4th C. B.C.	"	Ochres Lime. Egyptian blue Ochres	Lime	"
Greece	5th-4th C. B.C.	?	?	?	No example of painting
Pompeian	4th C. B.C.-1st C. A.D.	Lime Plaster	Ochres Carbon Egyptian blue Egyptian green	1. Albumin Glue 2. Lime	Fresco Fresco-secco Tempera
Christian Catacombs	1st C. A.D.-3rd C. A.D.	"	?	?	

V. Painting Technique from Literary Sources.

There are at least four important treatises on the technique of Indian painting, namely, the Vishnudharmottara⁷⁸ (7th century A.D.), the Abhilashitārtha Chintāmaṇi⁷⁹ (1125 A.D.) of Somadeva III of the Chālukyan dynasty, the Śilparatna⁸⁰ (16th century A.D.) of Śrī Kumāra, a work of Travancore origin, and the Śivatatva Ratnākara⁸¹ (late 17th or early 18th century A.D.) of Basavarāja, a compilation of Kannaḍa origin. The last treatise depends almost wholly on the Abhilashitārtha Chintāmaṇi.

Let us examine how far the technique of wall painting described in these texts conforms to actual practice as revealed in the chemical investigations on the paintings. We are giving below the technique described in these texts in a tabular form⁸²:—

Vishnudharmottara	Abhilashitārtha Chintāmaṇi.	Śilparatna.
Ground.	Ground.	Ground.
Rough Plaster :—A mixture of saffron, sesame oil, gum, resin, beeswax, liquorice molasses, <i>Phaseolus munga</i> , brick powder, clay, caustic lime, fruits of <i>Feronia elephantum</i>	Rough Plaster :—A mixture of clay and animal glue is prepared which is used as the rough plaster (The walls are covered with three coats of this mixture).	Rough Plaster :—A mixture is prepared of limestone, shells, extracts from the barks of <i>Ficus religiosa</i> , <i>Embllica officinalis</i> , <i>Etiocarpus ganitrus</i> , <i>Nauclea kadamba</i> , and <i>Andropo-</i>

78. St. Kramrisch—Vishnudharmottara—Jour. of the Depart of Letters, Calcutta University, Vol. XI (1924).

79. Ananda K. Coomaraswamy—Technique and Theory of Indian Painting—Technical Studies Vol. III (1934-35), p. 59.

80. Ananda K. Coomaraswamy—Citralakshana, Sir Asutosh Memorial Volume (1926-28), pp. 53-56.

K. P. Jayaswal—A Hindu Text on Painting—Journ. of Bihar and Orissa Research Society Vol. IX (1923), pp. 30-39.

81. C. Sivaramamurti—Fresco Painting in Sivatatvaratnakara, Triveni, Vol. V, No. 1 (1932-33), pp. 76-82.

82. The author is very much indebted to Dr. V. Raghavan, Sri T. V. Ramachandra Dikshadar and Dr. T. R. Chintamani for translating the texts for him. The author has also consulted the translation of the texts by Dr. St. Kramrisch, Dr. Ananda K. Coomaraswamy and Mr. K. P. Jayaswal. Wherever there are differences of opinion in the interpretation of the texts, the author has taken what is acceptable from a chemical point of view. The proportions of the various substances mentioned in the texts are not clear. Since they are not particularly relevant to the chemical discussion, they have been omitted here.

Vishṇudharmottara.	Abhilashitārtha Chintāmaṇi.	Śilparatna.
<i>Ground.</i>	<i>Ground.</i>	<i>Ground.</i>
maahaka* and Kasha* is worked with sugar water and allowed to dry for a month till it becomes a semi-solid. It is then used as the rough plaster.	A mixture of powdered conch-shells, sugar and arḍmal glue is given as the fourth coat.	gon mauricatum. To this is added hot water extract of myrobalan and <i>Phaseolus munga</i> . Another mixture is prepared of curd, milk, hot water extract of <i>Phaseolus munga</i> , molasses, ghee, plantain fruits, cocoanut water and mango juice. The above two preparations are mixed together and the following substances added, namely, honey, ghee, ripe plantain fruit, cocoanut water, aqueous extract of <i>Ficus religiosa</i> , milk, curd, molasses, slimy aqueous extract of myrobalans and water. The mixture is kept for a day till it hardens. It is pounded and after ten days is mixed with limestone, shells, lime and sand and pounded again and the materials used as plaster.
		OR
		A mixture of lime and sand is worked with hot aqueous extract of <i>Phaseolus munga</i> , molasses, and ripe plantain fruit. It is then put in a vessel and macerated and allowed to dry. At the end of three months, the contents are pounded, and mixed with molasses until it attains the consistency of butter. This is then used as the rough plaster.

Vishṇudharmottara.	Abhilashitārtha Chintāmaṇi.	Śilparatna.
<i>Ground.</i>	<i>Ground.</i>	<i>Ground.</i>
<i>Fine Plaster</i> A mixture of clay, resin of <i>Shorea robusta</i> and sesame oil acts as the fine plaster. The surface of the fine plaster is smoothened with sesame oil and milk.	<i>Fine Plaster.</i> A mixture of Naga and glue serves as the fine plaster.	<i>Fine Plaster</i> A mixture of conch, oyster shells or white clay worked with the gum of neem or <i>Feronia elephantum</i> serves as the fine plaster. Another method of preparing fine plaster consists of slaked lime worked with cocoanut water.
<i>Pigments.</i> Gold, silver, copper, brass, lead, tin (as leaves or as powder) mica, ivory. Orpiment, myrobalan, lac, vermillion indigo.	<i>Pigments.</i> Conch, Cinnabar, lac juice, red ochre, orpiment, lamp black, indigo lapis lazuli, gold (as powder).	<i>Pigments.</i> Yellow ochre, orpiment, red ochre, red lead, lamp black, lac dye, gold.
<i>Binding Medium</i> Gum of <i>Grisela tomentosa</i> .	<i>Binding Medium</i> Animal glue	<i>Binding Medium</i> Gum of neem or <i>Feronia elephantum</i> .

Chemistry of the Processes described in the texts :—

Vishṇudharmottara.

The preparation of the ground is complex. The chief ingredients of the ground are the brick powder, clay and caustic lime, the remaining substances serving as mere binding agents. Caustic lime would help to consolidate the plaster in the process of conversion into carbonate. This has not been taken advantage of by the artist. This is evident from the fact that the caustic lime has been allowed to carbonate and dry for a month. It is a conclusive proof that the artists of Vishṇudharmottara were ignorant of fresco technique.

The consolidation of the ground has been brought about by (a) sesame oil, which is a semi-drying oil, (b) saponification of the sesame oil, (c) gums in aqueous solutions (d) resins and beeswax dissolving in the sesame oil, (e) Colloids⁸³ and gums present

* The significance of these sanskrit terms is not clear.

83. Colloids make the mixture plastic and harden it. Vide Searle—Loc. cit.

in the molasses, (f) Starches and colloids present in liquorice, *Phaseolus munga*, fruits of *Feronia elephantum*, (g) casein in milk. The last substance also gives a better tone to the surface. Thus a tempera technique has been employed in laying the ground.

The use of saffron⁸⁴ in the ground is inexplicable. It is an yellow colouring matter soluble in water and obtained from the flowers of *Crocus sativus*. In Europe, it has been used in Medieval paintings for enriching greens and blues. But its fugitive character has prevented its use for wall paintings. Probably it was intended to give an yellowish shade to the grounds.

The pigments have been laid in tempera technique using gum.

Abhilashitārtha Chintāmaṇi.

The preparation of the ground in *Abhilashitārtha Chintāmaṇi* is less complex than that recommended in *Vishṇudharmottara*, the ingredients being mainly confined to clay, powdered conch, sugar, Naga (?) and animal glue. The ground and the pigments have been laid in tempera with animal glue.

The purpose of the sugar was just to attract moisture so that the plaster might be kept moist and in a workable condition.⁸⁵

Śilparatna.

There are two recipes given in this text for preparing the ground. In the first, the main ingredients are limestone and shells, the remaining substances merely serving as binding agents. The consolidation of the ground is brought about by (a) colloids in the extracts of *Ficus religiosa*, *Emblica officinalis*, *Eliocarpus ganitrus*, *Nauclea kadamba*, *Andropogon mauricatum*, *myrobalan* and *Phaseolus munga*.⁸⁶ (b) Starches and colloids in plantain fruits, coconut water and mango juice (c) colloids and gums in molasses (d) gums (e) casein in milk and curd (f) ghee which is semi-drying (g) honey which is sticky. (Since it is hygroscopic, it also keeps the mixture moist and workable.)

The principal ingredients in the second recipe consist of lime and sand. But the artist has not taken advantage of the consoli-

dating properties of the caustic lime, for he has allowed it to become carbonate and used the latter for the plaster. Hence he was obviously ignorant of the fresco technique.

The plaster has become consolidated through (a) proteins and colloids in *Phaseolus munga*, (b) starches and colloids in the plantain fruit and (c) gums and colloids from molasses in the second recipe.

There are two methods of preparing the *fine plaster*. In the first, conch, oyster shells or white clay are mixed with gum. Here gum serves as the binding agent. In other words, the *fine plaster* has been laid in tempera technique. According to the second method, the *fine plaster* is prepared by mixing slaked lime and coconut water. Hence the method adopted is one of *pure fresco*. But it is surprising that the artists who knew the fresco process in laying the *fine plaster* did not adopt it for the *rough plaster*.

The ground has been prepared either in tempera or by both tempera and fresco processes. The pigments have been applied in tempera using gum.

The texts are, however, silent about the fresco technique in laying the pigment.

Chemical Investigations and Textual Methods of Painting.

We shall next examine how far the details given in the texts are supported by the results of chemical investigations connected with painting methods and materials in India. We shall first deal with pigments and then with binding media.

It will be evident that of the pigments mentioned in *Vishṇudharmottaram*, orpiment is found only at Ajanta. The others have not so far been found in any of the sites. The pigments mentioned in the *Abhilashitārtha Chintāmaṇi* are used in Indian sites. Red ochre, and lamp black occur in all the sites. Orpiment is found at Ajanta. Lapis lazuli has been found at Ajanta, Bāgh, Tanjore and elsewhere. Yellow and red ochres and lamp black are some of the pigments referred to in *Śilparatna*, which occur extensively in Indian paintings.

So far as the binding media are concerned, *Vishṇudharmottara* and *Śilparatna* recommend gum and *Abhilashitārtha Chintāmaṇi*, glue. Glue has been employed with pigments in Ajanta, Bāgh and Bādāmi. According to *Abhilashitārtha Chintāmaṇi*, even the ground is in tempera using animal glue as the binding medium. Except Bādāmi no other site employs glue in the ground.

84. Thompson—The Materials of Medieval Painting (New Haven: Yale University Press, 1936), pp. 184-86.

85. Thompson—Loc. cit., pp. 56, 57, 61, 204, 209.

86. Sometimes juices of plants were used instead of gum to bring about consolidation. Vide Thompson. Loc. cit., pp. 61, 170, 209.

There is the use of gum in southern technique but it is confined to black pigment.

In the preparation of the ground, there are two aspects to be considered: (1) principal materials of the plaster and (2) the binding agents in the plaster.

Vishṇudharmottara recommends brick powder (burnt clay) and caustic lime as the principal components of the ground. Abhilashitārtha Chintāmaṇi recommends the use of clay, conch shells and Naga (?), while Śilparatna prefers limestone and shells. Brick powder has not been found in any of the sites. This is evident from the microscopic examination of the Ajanta, Bāgh and Bādāmi plaster, which reveals hydrated yellow oxide of iron but not the anhydrous red oxide, thereby showing that the clay has not been burnt. Clay is used in large proportions in the northern technique but is negligible in the southern. Caustic lime has been extremely popular in the southern technique, but not in the northern, except as a wash to smoothen the surface of the rough plaster. There is no evidence that shells have been used in any of the sites.⁸⁷ Limestone has been used at Ellora, Lepākshi and Somapālayam but not in other sites.

The binding agents for the ground recommended in the different texts can be grouped together under the following general heads:

Vishṇudharmottaram	Abhilashitārtha Chintāmaṇi	Śilparatna
Sesame oil	Animal glue	Extracts of
Gum		<i>Ficus religiosa</i>
Resin		<i>Embilca officinalis</i>
Beeswax		<i>Eliocarpus ganitrus</i>
Molasses (Colloids & gums)		<i>Nauclea kadamba</i>
<i>Phaseolus munga</i>	Proteins Tannins Starches Colloids	<i>Andropogon mauricatum</i>
Fruits of		<i>Myrobalan</i>
<i>Feronia</i>		<i>Phaseolus munga</i> (Proteins, Tannins & Colloids)
elephantum		Plantain fruit
Liquorice		Cocoonut water
Milk (casein)		Mango juice
Maahaka (?)		(Tannins, Starches & Colloids)
Kasha (?)		Molasses (colloids & gums)
		Gum
		Honey
		Milk
		Curd
		Ghee (fat)
		Casein

87. Proc. Ind. Acad., Sci., VII, 4, 1938, p. 291 etc.

The results of chemical analysis of painting materials show that animal glue has been used for the ground only at Bādāmi. To that extent, the recipe given in the Abhilashitārtha Chintāmaṇi has been followed.

We shall now take up Vishṇudharmottara and Śilparatna. It has been shown that on ignition, the specimens of plaster suffer a loss in weight. This is due partly to the organic matter present in it. We shall now examine whether the organic matter includes any of the binding agents mentioned in the texts.

The binding agents mentioned in the texts are tabulated above, and can be classified under the following heads:

- Proteins including caseins.
- Carbohydrates.
- Oils, fats and waxes.
- Resins.
- Tannins.

It is unlikely that the organic binding agents would have disappeared in the course of centuries without leaving recognisable decomposition products.

Samples of plaster from different sites fail to answer Millon's test, xantho-protein reaction, Adamkiewicz-Hopkins reaction, thereby showing the absence of proteins. They fail to give spot tests with acid green⁸⁸ or with ammonia solution of iodoeosin.⁸⁹ Similarly they fail to answer the spot test with methyl violet.⁹⁰ These experiments clearly indicate the absence of casein, glue or drying oil. The samples of plaster fail to answer Molisch's test with α -naphthol. Thus carbohydrates, including gums, starches and sugars are absent. Ether extracts from 0.1% to 0.15% of organic matter from Bāgh and Ajanta plaster, which is acidic to methyl red suggesting the probable presence of resins in the ground. The other samples fail to give such tests. The ether extracts fail to show the presence of wax. They fail to give elaidin test, thus showing the absence of oils, fats and waxes. Samples of plaster has no Fehling reducing bodies before or after acid hydrolysis,

88. Wilhelm Ostwald—Iconoscopic Studies—Technical Studies IV, 1935-36, pp. 135-44.

89. Wilhelm Ostwald—Loc. cit., p. 141.

90. Wilhelm Ostwald—Loc cit., p. 139.

thereby showing the absence of tannins and polysaccharides.⁹¹ With the probable exception of resin, none of the other substances is present.

Thus Abhilashitārtha Chintāmapī is a fair reflection of actual painting processes in some of the Indian sites. But there are wide variations between the technical processes given in Vishṇudharmottaram and Śilparatna and that actually practised in the various sites.

The variations may be due to one or more of the following reasons :

(1) The authors might have been mere compilers without proper understanding of the technical processes they have described. They probably preferred to copy from older compilers or from what they heard rather than take the trouble of collecting information from the craftsmen themselves.

(2) Portions of these texts containing the practices actually in vogue at the different sites may have disappeared leaving behind less known methods of painting.

(3) The authors have perhaps omitted the technique with which the artist and the public of their times were familiar. Evidently the technique of Indian painting as revealed through chemical investigations was too well known to merit detailed description by the authors. Hence they probably confined their attention to less known processes.

(4) The artists were taught by tradition and zealously guarded the secrets of their craft, which was not unusual in the past. Thus what the authors have recorded is not what was actually practised.

BUTCHIREDDIPALEM PLATES OF SIMHAVARMAN II

By

M. SOMASEKHARA SARMA

This is a beautiful set of copper plates, discovered some years back by a ryot, named Satyavolu Venkata Subbareddy Garu, while digging for pāṭi earth, at a place, a mile distant from Butchireddipalem, a hamlet of Vavveru, Kovur taluq, Nellore district. These plates were in a rusty condition before they were cleaned. Through the kind offices of my friend Mr. K. Ramakotiswararao, M. L. A., Editor of the 'Triveni' and Mr. B. Gopalareddy, lately Minister for Local Self-Government, Madras, I was able to secure these for publication.

The plates are five in number, and are of uniform thickness. They measure 22.6 c.m. × 7 c.m., are quite smooth, and almost all the letters are incised rather deeply and hence we find the whole inscription very beautifully preserved. The plates are held together by a ring, which is about 8.5 c.m. in diameter. The ends of the ring are secured in the base of a circular seal about 2.5 c.m. in diameter. The seal bears in relief on a plane surface in the middle, a beautiful humped bull, recumbent and facing the right. Above the bull is seen, in faint line relief, an anchor, indicative of the vigorous maritime activity prevailing at the time. Beneath the anchor and the bull are lines in relief. When this set came to me, the ring had been cut and soldered again. The soldered joint is very clearly seen. I have no information as to who cut it. The plates were not arranged in their proper order. I cut the ring again for my study of the plates and for taking estampages.

All the plates are inscribed on both the sides except the first and the last which have each a blank side. Each side of the plates contains four lines of writing and the size of the letters is generally about .6 c.m. The characters are in no way different from those of the Uruvupalli plates of Yuvamahārāja Viṣṇugōpavarman. No numerals are marked on these plates, as in the Ongōḍu grant, No. 1 and in the Uruvupalli, Mān-gaḍūr and Pīkira grants. The characters may be classed as box-

91. Some of these reactions were confirmed by Mr. M. Srinivasan.

headed and the boxes here are smaller than those of the grants of Vākātaka Pravarasena. The style of writing in these plates is slightly more developed than in the Uruvupalli plates and the engraver exhibits a tendency to incise the letters in squares with a slight ornamental flourish, rather than in curves as in the Uruvupalli plates. For illustrating the tendency to draw in squares, the letters *ka*, *da*, *pa*, *ba*, *ma*, *ya*, *ra* and *sa* may be cited. More particularly, the flourish may be seen in the secondary form of *ya*. The secondary form of *ma* occurs four times and that of *ta* only once.

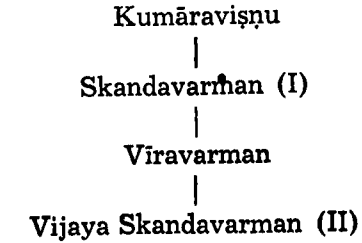
The language of the inscription is Sanskrit, and with the exception of the seven imprecatory verses at the end, it is entirely in prose. This grant was written by 'Rahasyādhikṛta Acyuta' at the oral command of the lord (king).

The record under review forms an addition to the seven charters already published, of the so-called Pallavas of the Sanskrit Charters, who ruled prior to the dynasty of Mahēndravarman. It opens with an invocation to Bhagavat, and mentions the donor Simhavarman as the great grandson of Viravarman, grandson of Skandavarman, son of Yuvamahārāja Viṣṇugōpa. Thus, it is evident that the donor Simhavarman is identical with his namesake, mentioned in the Ongōḍu grant B, the Pīkira and the Māṅgaḍūr grants, which have all been published in the *Epigraphia Indica* and the *Indian Antiquary*.

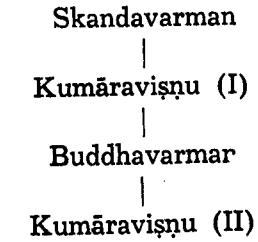
This inscription does not furnish any new historical information, this being almost another copy of the grants mentioned above differing from them only in respect of the donee and the village granted. As in the previous grants many laudatory epithets are prefixed to each name and they are identical with those given in the Ongōḍu grant B. This inscription, issued from 'Vijaya Paddukkarādhīsthāna' by Mahārāja Simhavarman, registers the gift of the village of Viḍhuvatti (l. 13), mentioned also as Vaṭṭagrāma (l. 21), to a brahman Viṣṇuśarman, of the Gautama gōtra and Chhandōga sūtra; the village was converted into a Brahmadēya, with the exception of fields in the enjoyment of gods (dēvabhōga), and freed from all taxation; the grant ends with the threat that those who transgress this order, would be corporally punished.

There is much difference of opinion among scholars on the pedigree of the Pallavas of the Sanskrit charters. The data supplied by the seven charters so far discovered are given below :

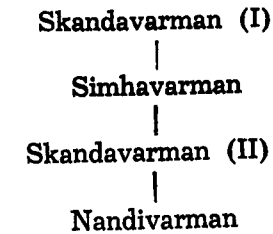
(i) Ongōḍu grant¹ No. A, issued from Tāmbrāpasthāna, by Vijaya Skandavarman, in his 33rd regnal year, on the 13th day of the third fortnight of winter, gives the following pedigree.



(ii) The pedigree known from the Cendalūr plates² of Kumāra Viṣṇu II, issued from Kāñci, in his 2nd regnal year, on the 5th day of the bright half of Kārttika, is as follows :



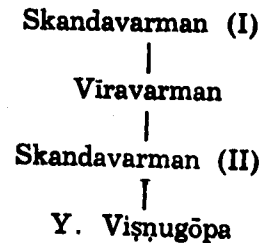
(iii) The Udayēndiram plates³ of Nandivarman, issued also from Kāñcīpura, in the first year of his reign, on the fifth day of the bright half of Vaiśākha, provide us with the following pedigree:



(iv) The Uruvupalli plates⁴ of yuvamahārāja Viṣṇugōpa, issued from Vijaya Palakkadasthāna, register a grant made by Viṣṇugōpa, in the eleventh year of a Simhavarman, on the 10th day

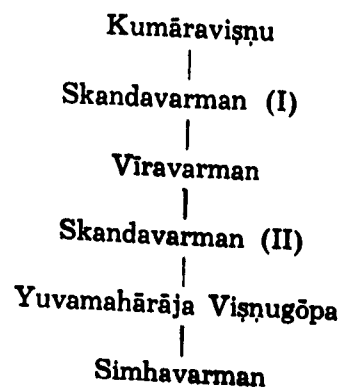
1. *Ep. Ind.*, Vol. XV, p. 249ff.
2. *Ep. Ind.*, Vol. VIII, p. 233ff.
3. *Ep. Ind.*, Vol. III, p. 142ff.
4. *Ind. Ant.*, Vol. V, p. 50ff.

of the dark fortnight of the month of Pausya. The pedigree known from these plates is given below :



The remaining three records, namely, (v) The Ongōḍu grant⁵ B, (vi) the Pīkīra,⁶ and (vii) the Māṅgādūr⁷ grants issued by Sihmavarman, son of Yuvamahārāja Viṣṇugōpa, carry the pedigree one generation further than the Uruvupalli plates. Of these the first charter issued from "Vijaya Skandhāvāra" in the 4th regnal year of the king, on the 5th day of the bright fortnight of Vaiśākha, records a gift made at the time of a Solar eclipse, without mentioning the month in which it occurred. The second and the third records were issued from Mēnmātura and Vijaya Daśanapura in the 5th and 8th years of Simhavarman, the first on the 3rd day of the bright half of Āśvayuja and the second on the 5th day of the bright half of the month of Caitra respectively.

Now, the pedigrees supplied by the Ongōḍu A, the Uruvupalli, the Ongōḍu B, Pīkīra and Māṅgaḍur grants may be combined as shown below :



5. *Ep. Ind.*, Vol. XV, p. 252 ff.

6. *Ep. Ind.*, Vol. VIII, p. 159 ff.

7. *Ind. Ant.*, Vol. V, p. 154 ff.

There remains Simhavarman, in whose reign Y. Viṣṇugōpa made a gift of land. Besides him, we have to accommodate the kings known from the Cendalūr and the Udayēndiram plates.

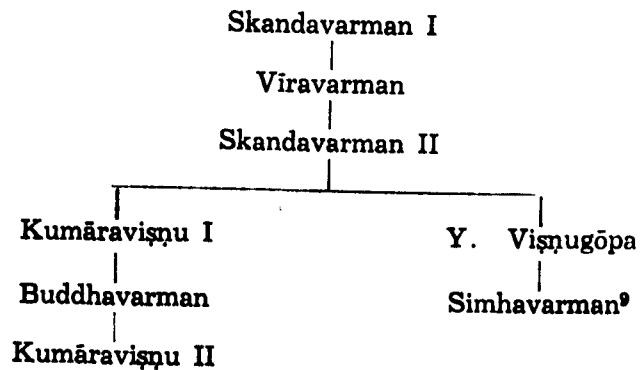
The above charters bring to light three kings bearing the name of Simhavarman; one in whose 11th year the grant recorded in them was made is mentioned in the Uruvupalli plates; the second was the son of Yuvamahārāja Viṣṇugōpa and the third was Simhavarman, son of Sivaskandavarman I and grandfather of Nandivarman of the Udayēndiram plates.

While editing the Pīkīra grant of Simhavarman, Dr. Hultzsch, instead of accepting Dr. Fleet's opinion that Simhavarman of the Uruvupalli plates was an unknown elder brother of Viṣṇugōpa, suggested that he was perhaps latter's son. He writes as follows :

"The term Yuvamahārāja or Yuvarāja which is prefixed to Viṣṇugōpa not only in his Uruvupalli grant, but in the two grants of his son Simhavarman, suggests that he never ascended the throne, but that the succession passed from his father Skandavarman II to his son Simhavarman. The reason of this need not have been premature death. If it is assumed that Viṣṇugōpa declined to take up the reins of government or was prevented from doing so by some other reason unknown he may well have been alive during the reign of his son Simhavarman to whose eleventh year I would assign—*lāghavāt* as an Indian philosopher will say—the Uruvupalli grant."⁸

Moreover, Dr. Hultzsch was inclined to identify Skandavarman of the Cendalūr plates with Skandavarman II, the grandson of Skandavarman I of the Uruvupalli grant. According to Dr. Hultzsch's suggestion if the pedigrees contained in the Cendalūr plates and the Uruvupalli, the Ongōḍu B., Pīkīra, and Māṅgaḍur grants are combined, we get the following table :

8. *Ep. Ind.*, Vol. VIII, pp. 160-161.



If the date given in the 'Lōkavibhāga' applies to Simhavarman, son of yuvamahārāja Viṣṇugōpa, then he must be the same king who anointed Ayyavarman of the Ganga dynasty to the Ganga kingdom. The Penukonḍa plates of Mādhavarman II say that he was installed by Skandavarman, a Pallava king. As the Ganga kings Ayyavarman and Mādhava II stand in relation to each other as father and son, it is reasonable to suppose that the Pallava kings who installed these also should stand in the same relation to each other. According to the genealogy given above, we know of no Skandavarman, son of Simhavarman and grandson of Viṣṇugōpa. Nor do we find any contemporary of his by name Skandavarman. According to the above genealogical arrangement, Simhavarman and Skandavarman, the predecessors of Nandivarman of the Udayēndiram grant cannot be taken to have ruled Kāñcī, since it was in possession of Kumāra-*viṣṇu* II and of his predecessors. It is impossible for two collateral and contemporaneous branches

9. Mr. H. Krishnasastry, while editing the Ongōḍu plates, merely states the view of Dr. Hultzsch (*Ep. Ind.*, Vol. XV, p. 349); but ascribes Ongōḍu B grant to Simhavarman II and states that the date given in the 'Lōkavibhāga' yields for Simhavarman II, the initial date A.D. 436. He writes: "The statement in the 'Lōkavibhāga' that Simhavarman was the lord at Kāñcī is also an indirect confirmation of the fact that Kumāra-*viṣṇu*, the uncle of Simhavarman II, recaptured, as stated in the Vēlūrpalayam plates, the capital town of Conjeeveram, which the immediate predecessors of Kumāra-*viṣṇu* had evidently lost, their grants being dated from Tāmbrāpa, Mēnmātura, Palakkāḍa and Daśanapura, while their still earlier predecessors referred to Kāñcīpura (Conjeeveram) as their capital." (p. 253). All through the article he adheres to the view of Dr. Hultzsch and does not mention that there was Simhavarman I. Unless one agrees with Dr. Fleet and J. Dubreuil, no Simhavarman I comes before Simhavarman, son of yuvamahārāja Viṣṇugōpa. Where are we to find Simhavarman I, when he speaks of Simhavarman II and yet adheres to the view of Dr. Hultzsch?

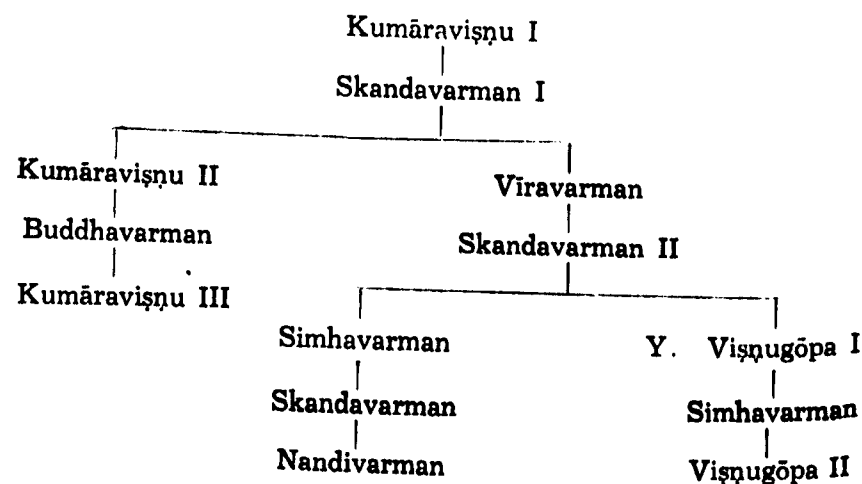
of the same dynasty to rule from the same capital. Moreover, if the date known from the 'Lōkavibhāga' is applied to Simhavarman, son of Viṣṇugōpa, it should be admitted that he was also ruling from Kāñcī, for the author of the 'Lōkavibhāga' refers to 'Kāñcīśa'.

For these reasons, along with Fleet and Dubreuil, I take Simhavarman of the Uruvupalli grant to be the eldest brother of y. Viṣṇugōpa and identical with Simhavarman of the Udayēndiram plates. Then, Nandivarman and Simhavarman become kings of collateral branches. Judged by the places donated in the Sanskrit charters mentioned above as well as the places from which they were issued, it seems as if the kings known to us from the Uruvupalli, Ongōḍu, Pīkira and Māngaḍūr grants, held sway probably in the Nellore district.

Now, the kings known from the Cendalūr plates of Kumāra-*viṣṇu* are to be accommodated. The letters of the Cendalūr record as well as those of the records of Simhavarman, son of yuvamahārāja Viṣṇugōpa, have been carefully compared and examined by scholars. Dr. Hultzsch was of opinion that *ra* and *ka* were more developed in the Cendalūr plates than in the Uruvupalli, Māngaḍūr and Pīkira grants. But "if the letters *ra* and *ka*," says Dubreuil, "were in fact developed a little more, there was a set of other letters such as *ha*, *ya*, etc., which were developed a little less". So, "on comparing the letters individually", he comes to the conclusion that "the Cendalūr document was contemporaneous with the other three". But palaeography by itself is not a sound test in determining precisely the date of a grant. It can only indicate the period or the century in which it was inscribed. For a period of two or three generations there may not be any perceptible difference in the development of letters. It is, thus, hazardous to fix the time and relative positions of kings, known from the Cendalūr plates in the genealogical table, depending solely on the palaeographical evidence. But some points in the phraseology of these grants are worth noting, namely: (1) the presence of the terms 'satyātmanō', 'amitātmanō'¹⁰ 'mahātmanō' in the grants of Kumāra-*viṣṇu*, yuvamahārāja Viṣṇugōpā, Nandivarman and

10. Since the Darsi plate contains the term "amitātmanō", and the qualifying epithets of "Vira-Kōrcavarman" are word for word the same as those applied to Viravarman in the Ongōḍu grant No. B, I am inclined to think that it belongs to one of the successors of Skandavarman II and particularly of Simhavarman, son of yuvamahārāja Viṣṇugōpavarman. I am of opinion that Virakōrcavarman and Viravarman are identical.

Simhavarman, son of Viṣṇugōpa. These epithets are not to be found in the Ongōḍu A., of Skandavarman II. Hence it may be presumed that these came into use only after the generation of Skandavarman II; (2) As Hultsch points out "there is a great resemblance between the phraseology of the Cendalūr plates and that of the Uruvupalli, Māṅgaḍūr and Pikira grants". Yet the qualifying phrases attached to Skandavarman II in the Ongōḍu No. A., are comparatively small in number and short in length, whereas in the other grants the tendency to increase their number as well as length is clearly noticeable. The grants of Simhavarman, son of Viṣṇugōpa, seem to have been fully developed in this respect. So Kumāraviṣṇu's place may be fixed, in the table, before that of Simhavarman and after that of Skandavarman II; (3) The passage "Kaliyugadōṣāvasannadharmōddharaṇa-nityasannaddhō" appears in the grants of Viṣṇugōpa, of his son Simhavarman and of Nandivarman and Kumāraviṣṇu II. So, just like the terms "Satyātmanō" etc., this passage also comes into use in the Pallava grants after Skandavarman II and before Simhavarman, son of Viṣṇugōpa. Hence, I am of opinion that Kumāraviṣṇu and Viṣṇugōpa might have been contemporaries. If, on the grounds mentioned above, this position is admitted, then Kumāraviṣṇu I and his son Buddhavarman of the Cendalūr plates must have been contemporaries of Viravarman, and his son Skandavarman II, the grandfather and father of Viṣṇugōpa respectively. Then the genealogy^{10a} of the Pallavas of the Sanskrit charters will be as follows:



10a. It is interesting to note here that, working independently of each other, Dr. K. R. Subramanian and I arrived at the same kind of scheme of the Early

In arranging the genealogy thus, I am not unaware of one serious difficulty that confronts us. Kumāraviṣṇu III, son of Buddhavarman, and Simhavarman who was taken to be a brother of yuvamahārāja Viṣṇugōpa and to be identical with Simhavarman of the 'Lōkavibhāga', belong to one and the same generation. They both ruled from Kāñcī. How is it possible for two contemporary kings of the same generation to rule from the same capital Kāñcī? My answer is this: Kumāraviṣṇu III might have ruled for a short time, after which Simhavarman might have taken possession of Kāñcī and ruled the kingdom. It is neither improbable nor impossible for two contemporaries to rule from the same capital one after another. The genealogy of the early Pallavas of the Sanskrit charters, when framed as shown above, satisfies not only the test of palaeography according to Dubreuil but also that of the formal phraseology of the epigraphs.

I do not propose to refer to the Vāyalūr record¹¹ and the Velūrpālayam plates¹² at length, the two documents often quoted in the formulation of the early Pallava genealogy.

The Vāyalūr inscription is but a jumble of names and the Velūrpālayam record does not provide us with any continuous and consecutive genealogy. Even between these two records the Velūrpālayam plates are more useful. These mention the earlier Pallava names in the order of father and son only up to Kumāraviṣṇu. The relation between Kumāraviṣṇu and the two Pallava names next mentioned, namely, Buddhavarman and Viṣṇugōpa is not stated; but these names are mentioned as if in the order of regular succession. If Skandaśiṣya of the Velūrpālayam plates is identified with Skandavarman of the Cendalūr plates it may be taken for granted that the three generations of kings, Skandaśiṣya, Kumāraviṣṇu and Buddhavarman of the former set, agree with those of the latter record and stand in relation to one another as father and son. Then they precede Viṣṇugōpa who is mentioned after Buddhavarman in the Velūrpālayam plates. Jouveau Dubreuil who has carefully studied the palaeography of the plates gives out his opinion that these were nearly contemporaneous with the Uruvupalli record—a position which was already arrived at by the

Pallava genealogy—Vide his "Buddhist Remains in Andhra and Andhra History", p. 101.

11. *Ep. Ind.*, Vol. XVIII, p. 145 ff.

12. *S.I.I.*, Vol. II, part V, p. 500ff.

comparison of phraseology contained in different records. The genealogy which I have given above, does not differ much from that formulated by Dubreuil.¹³

There are not enough of astronomical details given to calculate and verify the date of the grant under review, issued by Simhavarman II, on the 5th day of the bright fortnight of the month of Śrāvaṇa, in the tenth year of his rule.

So far, the date in the Lōkavibhāga forms almost the sole bed-rock of the early Pallava chronology, since it supplies us with the definite date of Śaka 380 or 458 A.D., equivalent to the 22nd regnal

13. Dr. K. R. Subramanian, the author of "Buddhist remains in Andhra and Andhra History", anticipates a chronological difficulty of a serious kind in the genealogy of the kings of the Sanskrit charters, as arranged by Dubreuil (Vide, p. 97). The difficulty he points out is this: the donor of the Chendaluru plates of about the fifth century is placed a generation earlier than Skandavarman, donor of the Ongōḍu No. 1 grant, which, being given in his 33rd year, was nearer the age of the Prākṛit grants in point of dating, etc. This does not seem to be as serious a difficulty as he thinks it to be. The dating of the Ongōḍu, No. 1, is no doubt exactly similar to that of the Prākṛit grants, like the Hirahāḍagaḷli plates of Śivaskandavarman; but this kind of dating the grants persisted even to a very late period, later than that of the Prākṛit grants. Just as the dates according to the lunar and solar reckoning co-existed in later times as is evidenced by the Eastern Cālukyan grants, this kind of dating akin to the one used in the Prākṛit grants, co-existed with the luni-solar month dating. The proof of this point of view is furnished by the early Kadamba grants. There are altogether five grants of Kadamba Mṛgēśavarman, son of Śāntivarman and grandson of Kākutsthavarman. His inscriptions are in 'box-headed' characters and belong to more or less the same period as the Uruvupalli inscription. A grant (*Ind. Ant.*, Vol. VII, p. 35ff) of the 3rd year of Mṛgēśavarman was dated in Kārttikamāsa on bahulapakṣa daśami; another grant (*Ind. Ant.*, Vol. VII, p. 37ff) of his, of the 4th year was dated in Varṣapakṣa eighth fortnight—rainy season—purnami (full moon day). Here we find both kinds of dating. Again two other grants (*Ep. Carn.*, Vol. IV, Hs. 18ff; *Ep. Carn.*, Vol. VIII, Sb. 33) of his 7th and 8th regnal years, are dated in 'Mārgaśira Śuklapakṣa daśami' and 'Vaiśākha purnami' respectively. Similarly, we find both kinds of dating in the grants of Mṛgēśavarman's son Ravivarman. A grant (*Ind. Ant.*, Vol. VI, p. 27ff) of his 11th regnal year, issued from Palāśika was dated in the Hēmanṭa, sixth fortnight, on the 10th day. The other grants of his reign are all dated in lunar month calculation.

This kind of dating the grants was prevalent even during the rule of Viṣṇukunḍin Gōvindavarman's son Mādhavarman who issued his grant (*Ep. Ind.*, Vol. XVIII, p. 334ff) in his 37th regnal year, on the 15th day of Grīṣma (the hot season), the seventh fortnight. Mādhavarman, son of Dēvavarman

year of Simhavarman, the ruler of Kāñcīpura. This Simhavarman is taken to be identical with the supposed elder brother of yuvamahārāja Viṣṇugōpa. Thus, this grant of Simhavarman II may be safely assigned to the last quarter of the fifth century A.D.

It may not be wrong to suppose that Simhavarman ruled till 460 A.D., for a normal period of nearly 24 or 25 years. During his rule, Viṣṇugōpa was a yuvamahārāja under him and ruled perhaps his northern dominions. After his brother's death he probably threw off his allegiance to the ruling family of Kāñcī and asserted his independence; or if at all he was subordinate, he was so only in name, exercising his full power over his dominion. His rule¹⁴ lasted perhaps for a period of nearly twenty-five years, that is, up to cir. 485 A.D. when he was succeeded by his son, Simhavarman II to the throne. If the eclipse referred to in his Ongōḍu grant (B), issued in his 4th regnal year, on the 5th day of the bright fortnight of the month of Vaiśākha were a solar one, occurring on the previous Amāvāsya day of the month of Caitra, then we have a solar eclipse recorded in the month of Caitra in the year 488 A.D., on the 28th of March. If this were taken to be correct, Simhavarman's accession to the throne may be fixed in 485 A.D. According to this calculation the date of the grant under review would be A.D. 494-495.

Skandavarman, the contemporary of Simhavarman II, was the Pallava king who crowned Mādhava II, son of Ayyavarman or

and grandson of Mādhavarman, issued his grant (*Ep. Ind.*, Vol. XVII, p. 337ff) in his 47th year, on the 7th day of the 7th fortnight of the rainy season. The date of the Cikkūḷa plates (*Ep. Ind.*, Vol. IV, p. 193ff) is the fifth day of the 8th fortnight of the summer season in the 10th regnal year of Vikramēndravarmā; but the Rāmatīrtham plates (*Ep. Ind.*, Vol. XII, p. 133ff) of Indravarmā are dated in his 27th regnal year, on the 7th tithi of the bright fortnight of Jyēṣṭha māsa.

Yet another example is furnished from the Eastern Cālukyan records of even as late as the seventh century. Jayasimhavallabha, son of Kubja Viṣṇuvardhana issued his Pulombūru grant (*Ep. Ind.*, Vol. XIX, p. 254ff) in his fifth regnal year, on the 7th day of the 8th fortnight of Grīṣma (hot season).

Thus, the examples cited above are enough to prove beyond doubt that the kind of dating that existed in the Prākṛit grants survived to a date much later than those records.

14. I agree with Rao Bahadur C. R. Krishnamachari in taking Viṣṇugōpa, father of Simhavarman II, to have ruled as Mahārāja for some time. He was right in pointing out the analogy of Mangi Yuvarāja of the Eastern Cālukyan dynasty to prove his point.

Aryavarman and grandson of Mādhava I of the Ganga dynasty. Mādhava I is said to have secured a kingdom through the favour of the Jain ascetic Simhanandi, who may be identical with Simhanandi or Harinandi of the Paṭṭāvalis of Sarasvatigachcha of Balātkāragana of the Mūlasangha. Rudolf Hoernle, who has studied these Paṭṭāvalis carefully and calculated the dates of the Pontiffs according to Jain tradition, assigns the date A.D. 451 to Simhanandi.¹⁵ Even viewed from this point of view Mādhava II, grandson of Mādhava I, a disciple of Simhanandi, seems to have been ruling during the last quarter of the fifth century A.D. So, the record under review, of Simhavarman II, a contemporary of Pallava Skandavarman of Kāñci and Gānga Mādhava II of Talakad, may be assigned to the last quarter of the fifth century without any hesitation.

This grant was issued from Vijaya Paddukkar-ādhiṣṭhāna by Simhavarman II and the village granted is Vaṭṭagrāma, also known as Viḍhuvattigrāma, situated in Muṇḍarāṣṭra.

Muṇḍarāṣṭra is mentioned not only in the grant under review but also in the Uruvupalli grant¹⁶ of yuvamahārāja Viṣṇugōpa and in the Pīkira grant¹⁷ of his son, Simhavarman. Uruvupalli and Pīkira are said to have been situated in Muṇḍarāṣṭra. The river Suprayōgā forms the eastern and southern boundary of Uruvupalli. The same river Suprayōgā is mentioned in another record also. The Mālepāḍu plates¹⁸ of Puṇyakumāra record a grant of Biripāḍu on the southern bank of the Suprayōgā. So, Biripāḍu in Hiranyarāṣṭra and Uruvupalli in Muṇḍarāṣṭra lie in opposite directions on the southern and northern banks of the river Suprayōgā. It is thus clear that the territorial divisions of Muṇḍarāṣṭra and Hiranyarāṣṭra lie to the north and south of the Suprayōgā.

Muṇḍarāṣṭra is said to have been situated roughly in the Nellore district.¹⁹ Now, let us see if its location can be fixed more precisely.

A perusal of the early inscriptions of the Pallavas and the Eastern Cālukyas makes it clear that, while the territorial divisions in the kingdom of the Cālukyas were designated as viṣayas or

nāḍus, those in the kingdom of the earlier Pallavas were termed as rāṣṭras. In course of time, with the penetration of the Eastern Cālukyan power southward into the early Pallava territory, viṣaya and nāḍu persisted and the term rāṣṭra dropped out. Thus Kammarāṣṭra of the Pallava grants was known as Kammanāḍu in the records of the eleventh and twelfth centuries.

Epigraphical records of the same period found in the Nellore district bring to our notice a territorial division named Muṇḍaināḍu, which may be taken to be no other than Muṇḍarāṣṭra of the Pallava charters. The identification, if possible, of the villages said to have been situated in Muṇḍaināḍu of the inscriptions of the later period, would help us to some extent in locating that nāḍu or rāṣṭra. The places where such inscriptions are found and the villages that are said to have been situated in Muṇḍaināḍu in those inscriptions are given below :

(1) Gaṇḍavaram.—“Kaṇṭhanārāyaṇapuram alias Kulōttunga-cōlapuram, situated in Muṇḍaināḍu.”²⁰ This Gaṇḍavaram, where the inscription is found, appears to be the modern name of “Kaṇṭhapura” or “Kaṇṭhāvura”, the contracted form of “Kaṇṭha (-nārāyaṇa-) pura.” This village Gaṇḍavaram is now in the Kovūr taluk.

(2) Koḍavalūru.—“Koḍavalūru (situated) in Muṇḍaināḍu.”²¹ This Koḍavalūru is identical with the present village of the same name, where this record is found. This is now in the Kovūr Taluk.

(3) Vēgūru.—“Vēlūru (situated) in Muṇḍaināḍu.”²² There are two Tamil inscriptions in the temple of Kailāsanātha in Vēgūru. In one record the name of the village is given as “Vēṅgūru”^{22a} and in the other as “Vēlūru”. The difference in the name of the village seems to be due to a mistake of the inscriber of the record. Since the village still bears the name of “Vēgūru” (modern form of Vēṅgūru) it is possible that the name of “Vēlūru” is wrong. This village of Vēgūru is now in the Kovūr Taluk.

(4) Nellore.—“Tāmaraimaḍuvu (the lotus tank) alias Citramēlinallūr in Muṇḍaināḍu.”²³ The village of Tāmaraimaḍuvu may

15. *Ind. Ant.*, Vol. XX, p. 351.

16. *Ind. Ant.*, Vol. V, p. 50ff.

17. *Ep. Ind.*, Vol. VIII, p. 160ff.

18. *Ep. Ind.*, Vol. XI, p. 337ff.

19. *Ep. Ind.*, Vol. XI, p. 342.

20. *Nel. Ins.*, Vol. II, N. 19, p. 779.

21. *Ibid.*, N. 31, p. 794.

22. *Ibid.*, N. 121, p. 888.

22a. *Ibid.*, N. 120, p. 887.

23. *Ibid.*, N. 72, p. 843.

be identified with the present village of Dāmaramaḍugu in the Kovūr taluk.

(5) Nellore.—“Māvaḍikuṇḍai in Muṇḍaināḍu”.²⁴ The village of Māvaḍikuṇḍai seems to be identical with Mōḍēkuṇṭa in the Kovūr taluk.

(6) Nellore.—“Alangāḍu in Muṇḍaināḍu”.²⁵ This village Alangāḍu is unidentifiable. There is a village called “Alagānipādu” in the Kovūr taluk of the Nellore district. Could it be that?

(7) Chikavolu [a hamlet of Yerragunṭapālēm (Rāpur taluk)]—“Takkulam (situated in) Muṇḍaināḍu”.²⁶ This village is unidentifiable.

(8) Bapatla (Guntur district).—“[Ve]lukaḷūru (situated in) Muṇḍaināḍu”.²⁷ This village is unidentifiable.

Except the three villages last mentioned in the above list namely, Alangāḍu, Takkulam and [Ve]lukaḷūru, all the others are identifiable and are now in the Kovur taluk of the Nellore district. If the above identifications are approved, and there is no reason to disapprove of them, then, it seems to me that the ancient Muṇḍarāṣṭra or Muṇḍaināḍu fairly corresponds to the Kovur taluk.^{27a} Since Muṇḍarāṣṭra corresponds to the Kovur taluk, the river Suprayōgā, its southern boundary, may, without any hesitation, be safely identified with the Pennār,²⁸ which divides the Kovur taluk from the Nellore taluk. South of the Pennār lies Hiranya-rāṣṭra of the Mālepāḍu plates.

That the Suprayōgā is no other than the Pennār becomes evident even by the Telugu version of the *Mārkaṇḍēya Purāṇa*, translated by Mārana, a contemporary of the Kākatiya monarch, Pratāpa

24. *Ibid.*, N. 61, p. 831.

25. *Ibid.*, N. 71, p. 841.

26. *Nel. Ins.*, Vol. III, R.8., p. 1216.

27. *Sou. Ind. Ins.*, Vol. VI, No. 173.

27a. Another ‘rāṣṭra’ of the Early Pallava Sanskrit charters—Vēṅḡrāṣṭra mentioned in the Māṅgaḍūr grant of Simhavarman II, son of Viṣṇugōpa,—also has not been identified. Some have taken it to be identical with the country of Vēṅḡ. But I am of opinion that the Early Pallava power never extended beyond the river Kṛṣṇā. Hence, I am inclined to identify it with the territory, around Vēṅgaḍam, Venkaṭācalam or Tirupati in the Chittoor district.

28. Mr. M. Venkataramayya rightly identifies the Suprayōgā with the river Pennār on other grounds (*Jour. Or. Res.*, Vol. XII, p. 363).

Rudra II of Warangal. While describing Bharatavarṣa, the author enumerates the rivers of the country, of which the Gōḍāvari, the Bhīmarathī, the Kṛṣṇavēṇā, the Tungabhadṛā, the Suprayōgā and the Kāvērī are said to have taken their rise in the Sahyaparvata.²⁹ Of these, the Gōḍāvari, the Kṛṣṇavēṇā and the Kāvērī are well known. The Bhīmarathī and the Tungabhadṛā are the reported tributaries of the Kṛṣṇā or Kṛṣṇavēṇā. The remaining other river Suprayōgā should be identified with the Pennār, the only river of repute south of the Tungabhadṛā and north of the Kāvērī. As a matter of fact, almost all the purāṇas mention the river Suprayōgā.³⁰ It could be no other than the Pennar.

Muṇḍarāṣṭra might have probably extended westward into the Atmakur taluk, adjacent to that of Kovur of the Nellore district.^{30a}

29. “సువాహిని పయోష్ణి నిర్వింధ్య నిషధావతి చైతరసి నీనీవారి కుముద్వతి
మహాగౌరి దుర్గ యంతశ్చిర యనుమహావాహినులు వింధ్యంబునం బుట్టె; గోదావరి భీమరథి
కృష్ణవేణి తుంగభద్ర సుప్రయోగ కావేరి యను నదులు సహ్యాపర్వతంబున నుద్భవించె”.
మార్కండేయ పురాణము; భారతవర్షవర్ణనము.

गोदावरी भीमरथी कृष्णवैष्णवा तथापरा
तुङ्गभद्रा सुप्रयोगा वाह्या कावेर्यथापगा
सह्यादादिनिष्क्रान्ता इत्येताः सरिदुत्तमाः

—*Mārkaṇḍēyapurāṇa*, ch. 54, v. 26.

30. Br. Pur. I, 2.17; Vāyu 45, 104; Matsya 114, 29. But Viṣṇudharmōttara mentions it as Suprakārā.

तुङ्गभद्रा सुप्रकारा वाह्या कावेरिका तथा

—1st Khaṇḍa, Ch. 10, v. 5.

Even in the *Mahābhārata*, both in the Vanaparva and in the Bhīmaparva, the river Suprayōgā is mentioned besides the rivers Vēṇā and Kṛṣṇavēṇā. *Vana.* 222, 24-26; *Bhī.* 9, 14-21. Thus, we come to know that there are more Vēṇās than one. Of these, the Kṛṣṇavēṇā is the river Kṛṣṇā, one Vēṇa or Tungavēṇa may be identified with the Tungabhadṛā; another Vēṇā with the Waingangā, the tributary of the Gōḍāvari; Upavēṇā may, probably, be said to be identical with the Southern Pennār. If these identifications hold good and are approved, then there will be no difficulty in taking the river Suprayōgā, to be identical with the Pennār, in spite of the profound confusion regarding the rivers, having the same name Vēṇa.

30a. As a matter of fact, an attempt was recently made by Mr. M. Venkataramayya in his article entitled “Notes on the ancient political geography of South India—2. Muṇḍarāṣṭra”, to fix with some precision, the location of

Now let us consider how Muṇḍarāṣṭra got its name. It was customary in ancient times to name the country after the tribe which inhabited it permanently. Thus, the countries of Kāśī, Kōsala, Kaṭṭiṅga, etc., were named after the tribes (Kāśīs, Kōśalas and Kaṭṭiṅgas, etc.,) which bore the same names. However, it is not definitely known if this was the custom regarding the comparatively small territorial divisions like rāṣṭras or viṣayas, even during the early centuries before and after Christ. But there is room enough to think that at least in some cases it was so. The territorial division of Hiraṇyārāṣṭra mentioned in the Mālepaḍu plates of Puṇyakumāra seems to have derived its name by being the original habitat of the clan of Hiraṇṇakas or Hiraṇyakas occurring in the Nāgārjunikoṇḍa inscriptions of the time of the Ikṣvāku kings.

The Muṇḍas now inhabit the plateau of Chota-Nagpur and the adjacent country. Most probably the territorial division of Kōlūvartani of the Kaṭṭiṅga grants,³¹ corresponding to the Chicacole taluk of the Ganjam district, got its name after the Kōls or Kolarians.

Did the Muṇḍas have any connection with Muṇḍarāṣṭra in the Nellore district? In other words, could this territorial division have derived its name by its being the original habitat of the Muṇḍas? Here it may be pointed out that some of the early South Indian Coins bear legends "Rāṇō Muṇḍānandasa". K. P. Jayaswal ascribed them to "the governor (of Muṇḍarāṣṭra) Muṇḍānanda."³² These coins and the term Muṇḍarāṣṭra are, in my opinion, reminiscent of the connection of the ancient Muṇḍas with the South. But anthropologists, ethnologists and linguists assert that the Muṇḍas never had any connection with the south or with the Dravidians. They do not approve of classing the Muṇḍas under

Muṇḍarāṣṭra by identifying the villages mentioned in the Uruvupalli grant of yuvamahārāja Viṣṇugōpa with certain villages in the Atmakur taluk, lying to the north of the Pennār, and Pīkīra of Simhavarman's grant with Pīgīlam in the Venkatagiri taluk, to the south of the same river. Even after making these identifications he defines Muṇḍarāṣṭra—perhaps by mistake—as the territory lying to the south of the Pennār and to the north of the Svārṇamukhi. Some more evidence is necessary to confirm the contention that Muṇḍarāṣṭra extended to the south of the river Pennār.

31. Bhārati, Vol. III, No. 5, p. 48.

32. *History of India*, K. P. Jayaswal, p. 187, fn. 1.

the Dravidian group. If the Muṇḍas have no such connection either with the South or with the Dravidians, then how are we to explain the anomaly of the connection of the term Muṇḍa with Muṇḍarāṣṭra? Dr. Grierson opined that the so-called Dravidian ethnic type may really be that of the Muṇḍas and should be called the Muṇḍa type.³³ But it must be admitted that his was not the final word on the subject.

The ethnological and anthropological problems relating to the Muṇḍa tribe have been studied much in recent years since Dr. Grierson expressed the above opinion. However, it must be recognised that the Muṇḍarian problem, which is beset with so many irreconcilable, though interesting, issues is still a hard nut to crack. There is yet no unanimity of opinion amongst scholars regarding the original stock to which the Muṇḍas belonged, their original home and the direction in which they came to the Chotā-Nagpur country where their settlements are now found. Fr. Schmidt propounded the theory that the Muṇḍa languages of India were related to the Nicobarese, the Khāsī and the Mon-Khmēr languages and termed the whole group as "the Austric family." In this connection, it may not be out of place to mention that the Talaings of Burma, acclaimed to have been the Telugus themselves, are said to have belonged to the Mon-Khmēr race. A. C. Haddon observes that the Muṇḍa-speaking peoples (Muṇḍa, Bhunjee, Ho, etc.) are stated to resemble so closely the Dravidians as to be indistinguishable from them.³⁴ "The puzzling Kolarians" says he, in his book on *The Races of Man*, "speak Muṇḍa languages allied to the Mon-Khmēr group of the Austric linguistic family, but in the Muṇḍari vocabulary there are numerous undoubted and probable Sanskrit words, and it has been suggested that the civilised Asur of Muṇḍa tradition may be the Pre-Aryan Asura who contested the valley of the Five Rivers, of the Ganges and the Jamuna against the "Aryan" immigrants, as related in the Rīg-Veda, and that they spoke an early form of Sanskrit or an allied language. There is something in the facial appearance of many Kolarians which enables an observer to pick out a typical inhabitant of Chota-Nagpur from a crowd of Southern Dravidians."³⁵ The theory of the "Austric family," which held its ground for nearly three decades is now being vehemently attacked and disproved by G. de Hevesey of

33. *Linguistic Survey of India*, Vol. IV—Munda and Dravidian languages.

34. A. C. Haddon—*The Wanderings of Peoples*, p. 28.

35. A. C. Haddon—*The Races of Man*, p. 108.

Paris. Thus, we see that the final word regarding the problems connected with the history of the Muṇḍas has yet to be uttered. I have ventured to deal with this subject simply to draw the attention of scholars to the existence, in times of yore, of Muṇḍarāṣṭra in the south, in the Nellore district, which, I presume, should have some connection with the Muṇḍas, be they the Muṇḍas of Chota-Nāgpur or not.

Another possibility of the origin of the name Muṇḍarāṣṭra. Jain tradition as preserved in Dharmāmṛta,³⁶ a Canarese Kāvya of the twelfth century, brings to light a line of rulers, known as Muṇḍiyas or Muṇḍakas, who held sway over the country of Vēṅgī, a term synonymous with a great part of the coastal Andhradēśa, according to the same work.

In brief the story is this. Once upon a time Yaśōdhara of the Ikṣvāku clan was ruling the kingdom of Vēṅgī with Pratipālapura (Bhaṭṭiprōlu ?) as his capital. He had three sons, namely, Anantavīrya, Śrīdhara and Priyabala. In his old age when Yaśōdhara thought of retiring to a forest for spending the rest of his life in the service of Jinendra, placing the burden of the kingdom on his sons, they insisted on accompanying their father to the forest. After a great deal of persuasion, the third son, Priyabala acceded to the request of his father to stay and rule the kingdom. Thereupon, Yaśōdhara, with his two elder sons, went away to the forest, got initiated into the mysteries of Jain religion by Viśvasēnācārya and made penance at the bidding of his guru. After some time Yaśō-

36. Dharmāmṛta is a Kannada Kāvya by Nayasēnadēva, disciple of Narēndrasēna Muni. The author was a native of Mulugoṇḍa in the Dharwad district of the Bombay presidency. The author himself says that he completed the work in Śaka 1037, in the cyclic year Nandana, on Sunday, the first tithi of the bright fortnight of Bhādrapada, when the moon was in Hasta. But it must be pointed out here that the Śaka year does not tally with the cyclic year, which was really Manmathā. Even if the Śaka year is taken to be current, the cyclic year will be Jaya but not Nandana. But it is to be noted that the details work out correctly for both the years Nandana and Manmathā.

This Kāvya in fourteen cantos or āśvāsas contains fourteen stories, one in each āśvāsa, dealing with the people who, in times of yore, attained Sadgati by acting up to the tenets to be observed by grhasthas or householders, namely, samyakdarśans, its eight angas or branches and anuvratas, such as ahimsā, satya, astēya, brahmacharya and aparigraha. The eleventh chapter of this work deals with the story of Satyavrata, a portion of which was narrated above in brief. The story of Satyavrata gives some interesting information regarding Jainism in the Telugu country.

dhara and Anantavīrya attained nirvāṇa. While Śrīdhara, otherwise known as Akalanka, was spending his days in penance, Priyabala at Pratipālapura died of snake-bite leaving no heir to the throne. Then the ministers and elders of the kingdom went to Śrīdhara to implore him to return to Pratipālapura and assume the reins of the government. They somehow succeeded in bringing him back to rule the kingdom till an heir to the throne was born to him. Śrīdhara retired to his forest abode sometime after the birth of his son Yaśōdhara, who was nicknamed as Muṇḍiyasuta or the son of the shaven monk. Hence, his descendants were called Muṇḍiyas or Muṇḍakas. The term Muṇḍarāṣṭra of the Āndhra country was applied perhaps to the territory which was intimately associated with and had become, later on, the permanent abode of the Muṇḍiyas or the Muṇḍakas, the descendants of Śrīdhara.

Divested of its legendary garb, the story in the Dharmāmṛta contains some historical facts which go to suggest that Jainism was perhaps introduced into the Telugu country and patronised by the Ikṣvākus who, according to this Kāvya, were Jains to start with.

The descendants of Śrīdhara, nicknamed as Muṇḍakas, Muṇḍiyas or Muṇḍas were all Ikṣvākus. The inscriptions discovered at Nāgārjunikoṇḍa (Palnād taluk, Guntur district) and Jaggayya-pēṭā (Nandigāma taluk, Krishna district) bring to light, as we know, a line of Ikṣvāku kings who held sway over the region south of the river Kṛṣṇā during the third and the fourth centuries of the Christian era. Muṇḍakas, Muṇḍiyas or Muṇḍas were, in all probability, a tribe of the Ikṣvāku clan, which extended its rule to the south, almost as far as the river Pennār. It seems certain that the Muṇḍarāṣṭra got its name by its being the original abode of the Muṇḍas in (very) ancient times—be they of the Ikṣvāku clan or some others, who were wholly unrelated and unconnected with them.

The grant was issued from the victorious city of Paddukkara. The name Paddukkara is interesting and novel. In ordinary parlance it might have its probable variants Padukkara or Paddukaḍa. The form Padukka(ra) reminds us of the port of Poduca, mentioned in the *Periplus of the Erythraean sea*.³⁷ In his geography of India Ptolemy also mentions this port as Podukē.³⁸ Dur-

37. *The Periplus of the Erythraean Sea*, edited and translated by Wilfred H. Schoff, p. 46, para 60.

38. *Ptolemy's Geography of India and Southern Asia* by J. W. McCrindle, p. 65.

ing the time of Ptolemy and of the author of the *Periplus of the Erythraean sea* Poduca or Podukē was a great seaport and a great emporium, to which merchants from Limyrike or Damirica or Damiladēsa and from the north used to resort. Ptolemy locates the port somewhere after the territory of 'Arournoi.' About 'Arournoi' McCrindle writes in his *Ptolemy's Geography of India* as follows :

"The territory of the Arournoi (Arvarnoi) was penetrated by the river Tyna and extended northward to Maisolia, the region watered by the river Maisolus in the lower parts of its course."

Now, which is the territory of the Arournoi? Arournoi becomes Aroṇṇa like Karṇa-Kaṇṇa, Hiranya, Hiranna, and Vēṇṇa-Vēṇṇā. On this analogy I identify Arournoi or Aroṇṇa of Ptolemy with Hiranya or Hirannarāṣṭra (Aroṇṇa or Hiranna, Iraṇṇa or Ironṇa-Aroṇṇa). It is said to have extended as far as the river Maisolus. Opinions differ regarding the identification of the river Maisolus. Some have identified it with the Gōdāvari and some with the Kṛṣṇā. If the Maisolus was identified with the river Kṛṣṇā, it was because, (1) of the similarity in name of Maisolus with Masulipatam, at the mouth of the Kṛṣṇā; (2) and of the fame of muslins in the lower valley of the Kṛṣṇā. But it must be remembered that the whole region from the mouth of the Kṛṣṇā to as far south as Pulicat was famous for its cloth industry, especially for muslins, and not a single particular locality on the coast. Besides this, the port Masulipatam is not such an ancient one as is commonly believed. It came into existence only during the fifteenth century. Thus the identification of the Maisolus with the river Kṛṣṇā rests on very feeble grounds. Yet, the belief that it is the same as the Kṛṣṇā has gained a general currency. I cannot accept this identification.

We know from the inscriptions that the region bordering on the southern bank of the river, Suprayōgā or the Pennār was Hiranya (Hiranna) rāṣṭra (Arournoi of Ptolemy). Then, could the river Maisolus be the Suprayōgā or the Pennār itself? There is reference to Maisolia even in the *Periplus of the Erythraean sea*. The passages concerned are quoted below :

"..... not far from the three marts we have mentioned (namely, Kamara, Podukē and Sopatma) lies Masalia, the sea-board of a country extending far inland. Here, immense quantities of fine muslins are manufactured..." (McCrindle.)

"About these places (namely, Kamara, Podukē and Sopatma) is the region of Masalia stretching a great way along the coast before the inland country; a great quantity of muslins is made here." (Wilfred H. Schoff.)

These two extracts make clear that (1) Masalia or Maisolia of Ptolemy was not far off from Podukē; (2) it was famous for its muslins; (3) it stretched far inland. In my opinion the term muslin was, in all probability, derived from Maisolia. The name of the country was Maisolia or Masolia or Masalia, the name of the river was Maisolus and the cotton fabrics produced in that country were called muslins (contracted form of Maisolins or Masolins). But it is generally believed that the term Muslin was derived from Mosul (Mausal or Mausil), a town on the river Tigris in Mesopotamia.³⁹ Yule in his dictionary Hobson-jobson accepts the view that muslin is derived from Mosul. But yet I was surprised to read a foot note to the passage about Muslin which is as follows :

"We have seen, however, somewhere an ingenious suggestion that the word really came from Maisolia (the country about Masulipatam, according to Ptolemy), which even in ancient times was famous for the cotton textures." (p. 600).

Yule does not seem to believe in the derivation and hence he relegated this passage to a foot note. The derivation is the same even according to Marco Polo. While writing about Mausal, Marco Polo (13th century) states that all the cloths of gold and silk called Masolins were made in that country.⁴⁰ In spite of these unequivocal statements, I still believe that the Muslin was derived at first from Maisolia. Mosul or Mausal was not an important place during the early centuries of the Christian era. It came to prominence from the fifth or the sixth century (vide-Encyclopaedia Moslemica s.v. Mosul). Nowhere is it reported to have been famous for muslins during the early centuries of the Christian era. In fact it was Ma'sūdī, the Arab historian and traveller, who first said that Muslin took its name from Mōsul.⁴¹ Ma'sūdī, whose full name was Abu-l-Hasan Alī Ibn Husan Ibn Ali-ul-Ma'sūdī, was born at Bagdad towards the close of the 9th century of the Christian era.

39. *Encyclopaedia Britannica*, Vol. XVIII, s.v. Mosul.

40. Yule's *Marco Polo*, Vol. I, p. 60.

41. Lieut.-Colonel Chesney—*The Expedition for the recovery of the rivers Euphrates and Tigris*.

But how did Maisolia get its name? The term Maisolia consists of two parts—Mai and Solia. Solia is a corrupt form of the word Cōla. Even the Ceylonese called the country of the Cōlas Soli. Marco Polo calls the kingdom of Ma'bar Soli. The Chinese traveller Hieun Tsiang, who visited India in the seventh century, mentions the country of Cu-li-ye identified with the country round Cuddapah and Kurnool. Cu-li-ye is Cōla or Sola. Hieun Tsiang mentions it as having been 2400 or 2500 li in circuit.⁴² A considerable number of epigraphical records was discovered in the Cuddapah and Kurnool districts which brought to light a dynasty of the Telugu Cōla kings of Rēnāḍu, claiming to have been the descendants of Karikāla Cōla. The Telugu Cōla king, Mahēndra, father of Puṇyakumāra of the Mālepāḍu plates,⁴³ seems to have been a subordinate and a contemporary of the Pallava king Mahēndravarmān of Kāñcī, who ruled at the beginning of the 7th century. Simhaviṣṇu, son of Nandivarman of the Telugu Cōla family and brother of Dhanañjaya, father of Mahēndra, must, I think, have been a contemporary of the Pallava king, Simhaviṣṇu, father of Mahēndravarmān Pallava. Thus we come to know that the Telugu Cōlas were ruling the Cuddapah country even during the 6th century. In that case, it may not be wrong to suppose that the Telugu Cōlas were there long before they acquired kingship in that region. Thus, Mai-solia in my opinion, was most probably the country of the Telugu Cōlas—the meaning of mai being great or middle. Since the river runs through the country of the Cōlas or Ma-Soli, it probably acquired the name of Mai-Solus or Ma-Solus. The country of Mai-Solia or Ma-Solia, no doubt, extended far inland and the Mai-Solus or the Pennār waters the region “in the lower part of its course”. It is needless to say that the country of the Cōlas was all of the black cotton soil, famous for its cotton produce from the earliest times even to the present day. It was for this reason that the cotton fabrics produced in this Ma-Solus or Mai-Solus country were renowned as Mai-Solins, or Muslins. If the Mai-Solus is thus taken to be a river of the Telugu Cōla country, then it may be no other than the Suprayōgā or the Pennār. It was because the Telugu Cōlas were ruling the coastal region from Kāñcī as far almost as the mouth of the Kṛṣṇā till the 13th or the 14th century that the coast line up to the Kṛṣṇā was called Cōlamāṇḍalatīra or the Cōramāṇḍel coast of the European travellers.

42. Beal's *Buddhist Records of the Western World*, Vol. II, p. 22.

43. *Ep. Ind.*, Vol. XI, p. 337ff.

Now, if the Mai-Solus is the Pennār or the Suprayōgā, the river Tyna which is said to penetrate through Arounoi or Hiranyarāṣṭra must, in all probability, be the Svāṇṇa (Svārṇa-mukhi) itself.

Now, reverting to Paddukkara or Podukē or Paduca we may take note of the fact that the Cūra gṛānt⁴⁴ of Viṣṇugōpavaramān II was issued from Palātkaṭa and the Uruvupalli grant of yuvmahārāja Viṣṇugōpa from the city of Palakkaḍa which seems to be a variant of Paddukkara or Padukkaḍa. Many instances may be cited to show that *ra* changes into *ḍa*. Hence, I am tempted to take Palakkaḍa, Palātkaṭa and Paddukkara, said to have been the capitals (“adhiṣṭhāna”) or chief towns of the Early Pallavas of the Sanskrit charters, all to be identical.

In this connection we are reminded of another town—Pālakkaka or Palakkaka of Ugrasēna—mentioned in the Allahabad pillar inscription⁴⁵ of Samudragupta. I believe Pālakkaka to be no other than Palakkaḍa, Palātkaṭa and Paddukkara. Thus, in my opinion, Podukē, Poduca, Pālakkaka, Palakkaḍa, Palātkaṭa and Paddukkara—all these are the corrupt forms of the name of one and the same town.

Daśanapura from which the Māṅgaḍūr grant⁴⁶ of Simhavarman II and the Darsi plates⁴⁷ (fragment) were issued, seems to be the Sanskritised form of Pallukaḍa (Padduk(k)ḍa) which signifies tooth city (Pal', 'Pallu', or 'Palu'-tooth and 'Kaḍa'—a fortified town or city as in Dhannakaḍa or Dhana-Kaṭaka).⁴⁸ Thus, if

44. *Ep. Ind.*, Vol. XXIV, p. 137 ff.

45. Fleet's *Cor. Insc. Ind.*, Vol. III, p. 7, l. 20; tr. p. 13.

46. *Ind. Ant.*, Vol. V, p. 154 ff.

47. *Ep. Ind.*, Vol. I, p. 398.

48. As a matter of fact, Burnell has taken Daśanapura to be a Sanskrit equivalent of Palakkaḍa—(Vide, *Elements of South Indian Palaeography*, p. 37—continuation of footnote, No. 1 on p. 36). But Hultzsch, while editing the Pīkīra grant of Simhavarman II (*Ep. Ind.*, Vol. VIII, p. 161), pointed out that the equation of Daśanapura with Palakkaḍa was unsound. He contends that Pallu for tooth is the correct form and its genitive should be 'paṇṭi' and 'kaḍa' “does not mean a town but a place, a side”. Fleet also remarks that Burnell's suggestion that Palakkaḍa derived its name from “Pallu-kaḍa” is unsound (*Dyn. Kan. Dist.*, p. 318, note 12). In spite of the remarks of Hultzsch and Fleet, I believe that Burnell is right in his suggestion. No doubt the Telugu word for tooth is 'pallu' or 'palu'. I take 'kaḍa' to be the corrupt form of the Sanskrit word 'Kaṭaka—a fortified town'. 'Pallu-kaḍa' or 'Palukaḍa' may be changed into 'Palakaḍa' or 'Palakkakaḍa' or 'Palkakaḍa' in

Daśanapura and Palakkaḍa or 'Paddukkara' are identical, the former cannot be Darsi (Darsi division of the Nellore district), as has been held by some scholars.⁴⁹ Now, let us see if this fort and the city of the early Pallavas can be successfully identified and located.

Only one place in South India has so many variant forms as Palakkaḍa and that is Pulicat. It is variously written and spelt in the accounts of the Company's servants and of the European travellers of the 16th, 17th and 18th centuries. I give below the different forms of both the places Palakkaḍa and Pulicat.

From inscriptions.	From Travellers' Accounts.
Palakkaḍa	.. Paleacatta (Floris, 1614).
Pālakkaka	.. Pallacatta (Philip Baldaeus, 1680).
	Paleacate (Martin Alfonso De Souza, 1543).
(Palakkaḍa)	.. Palicata or Palicate—1765* ⁵⁰
	Paleakate—1612*
	Paleacate—1644*—Hondius.
	Paliacate—1782*—Sonnerah.
	Palicate—1765*
	Palicat—1681*—Pringle
Paddukkara	.. Pallectat—(Master William Methold—1618-22)
(Paddukara)	.. Palliacat—1684*—Pringle
(Pallukaḍa)	.. Palliacatte or Pallectatte—1720*—Van der Aa
	Pollyacatt—1683*—Pringle
	Pollicatt—1765*
	Pollicat—1682*—Pringle
Poduca (Periplus)	.. Polica(t)—1681*—Pringle
Podukē (Ptolemy)	.. Polica(t)—1710*—Alex. Hamilton
	Pullicat—1679*—Streynsham Master
	Pulicat—1720*—Van der Aa

I have given the probable variants of Palakkaḍa and Paddukkara within brackets. By a comparison of the different forms of

common parlance. There are names of villages like 'Palukūru' analogous to 'Palukaḍa' in which the genitive singular of 'palu' or 'pallu' was not at all used.

49. *Ind. Ant.*, Vol. XL, (1908), p. 283.

50. In *Indian Antiquary*, Vol. XXX, R. C. Temple traces the history of some of the Anglo-Indian geographical terms in an article entitled "Extracts from the Log of a Voyage along the coast of India in 1746". All the forms of Pulicat which were in vogue in the asterisk-marked years above are taken from that article (Vide, pages 355-56).

Palakkaḍa or Paddukkara and Pulicat I am led to believe that they are both identical.⁵¹

The situation of Pulicat is too well known to mention. It is in the Ponneri taluk of the Chingleput district. Poduca or Podukē—identical with Palakkaḍa and Paddukkara—is not far from Arournoi or Hiranyarāṣṭra.

Regarding the identifications made above, I sum up the facts as follows:

(1) The river Suprayōgā separates Muṇḍarāṣṭra or Muṇḍa-nāḍu or Muṇḍaināḍu from Hiranyarāṣṭra.

(2) Muṇḍarāṣṭra corresponds to the present day taluk of Kovur in the Nellore district. It might have extended to the Atmakur taluk also.

(3) The river Suprayōgā, the southern boundary of Muṇḍarāṣṭra is identical with the Pennār

(4) Arournoi of Ptolemy is no other than Hiranyarāṣṭra of the early copper plate records. By being the original habitat of the clan of Hiraṇṇakas, mentioned in the Nāgārjunikoṇḍa inscriptions, that territory got the name of Hiraṇṇa or Hiranyarāṣṭra.

(5) Arournoi extends as far as the river Maisolus. So, as Arournoi is no other than Hiranyarāṣṭra which extends as far as the river Suprayōgā, the river Maisolus is identical with the Suprayōgā or the Pennār. The Maisolus derived its name, probably, by being the principal river of Maisolia (or the Telugu-Cōla

51. Burnell suggested long ago that Palakkaḍa might have been the modern Pulicat (Vide—*South Indian Palaeography*, second edition, p. 36). But Hultzsch, while editing the Darsi fragment, points out that this identification is untenable (*Ep. Ind.*, Vol. I, p. 398, footnote 5) because he opines that Pulicat is an Anglo-Indian corruption of 'Palavērkāḍu' ('Pazhavallcaud'), the old forest of Vēl trees. The term 'Pazhavallcaud', I may point out, came into vogue only during the 19th century—Vide R. C. Temple's above-mentioned article in *Ind. Ant.*, p. 356. Another interesting meaning of 'Puliacatta'—unmistakably Pulicat of the European travellers—was given by Philip Baldaeus, minister of the Word of God in Ceylon, during the later half of the 17th century. He writes about Pulicat as follows:—"Paliacatta, i.e., Old Fort, in the Malabar language, is seated at thirteen degrees twenty-two minutes of northern latitude, five long leagues from St. Thomas." Thus, it will be seen that the interpretation which Hultzsch sought to give to Pulicat was a new and late one and not current in the 17th century.

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country). The term Muslin (the contracted form of Maisolin or Masolin) was applied to the cotton fabric produced in Maisolia—the country of the black cotton soil.

(6) Paddukkara or Palakkaḍa or Pālakkaka is identified with Palikata or Pulicat.

(7) Podukē of Ptolemy is the same as Poduca of the *Periplus of the Erythraean sea*. According to Ptolemy it was very near Arournoi. Maisolia is not far from Poduca. The ancient port and great emporium of the early centuries—Podukē or Poduca is no other than Polica(t) or Pulica(t).

Incidentally I refer to another capital of these so called 'Pallavas of the Sanskrit charters'—Tāmrāpasthāna. It was from this place the Ongōḍu (A) grant^{51a} of Skandavarman was issued. Tāmrāpasthāna is, in my opinion, no other than Tāmrapurī, mentioned in the inscriptions^{51b} of the 11th and 12th centuries, found at Cēbrōlu in the Bapatla taluk of the Guntur district. In fact, Tāmrapurī is the Sanskrit equivalent of Cēbrōlu or Cēbrōlu. Thus, we know three seats of Government of the early Pallavas in the Telugu country, namely, (1) Dhannakaḍa (Dhanakaṭaka-Amarāvati); (2) Tāmrapurī or Cēbrōlu in the Guntur district, and (3) Palakkaḍa. These three capitals mark three stages in the contraction of the early Pallava power in the Coastal Telugu Country. It may be out of place here to discuss in detail the causes that led to the receding of the Pallavas towards Kāñci. Suffice it to say that it was probably mainly due to the aggression and expansion of the power of either the Ikṣvākus of the Solar race or the Kandāra chiefs of Ānanda gōtra,⁵² who like the Pallavas of Kāñci came into power during the post Śātavāhana period.

51a. *Ep. Ind.*, Vol. XV, p. 246 ff.

51b. *Sou. Ind. Ins.*, Vol. VI, Nos. 101 to 117.

52. Tāmrapurī or Tāmrapurī was one of the holy places of Śaivite cult, during the middle ages. It was the seat of Skanda or Kārtikēya. It is just possible that some of the early Pallavas like Skandavarman of the Sanskrit charters were named after Skanda, the lord of Tāmrapurī or it may be that the god Skanda was probably installed by some Pallava king who bore the name of Skanda. Here I am tempted to make another suggestion that Tāmrapurī might be Kandarapura or Kandāra, the capital of the chiefs of the Ānandagōtra, because Tāmrapura was also Skandāpura or Kandarapura—the city of Lord Skandā. Skandāpura or Skandāvura (like Dharmāvura, Bhīmāvura and Rājamahēndrāvura) may have its possible variants like Kandāvura

The village granted is Vaṭṭagrāma or Viḍhuvattigrāma.⁵³ I am inclined to identify this Viḍhuvattigrāma with Viḍuvalūru (Viḍhuvatti-ūru, Viḍuvatūru, or Viluvaḍūru) in the Kovūr taluk of the Nellore district.

The main interest of the grant lies in the list of taxes and dues remitted by the king and made over to the donee according to brahmadēya maryādā. But the passage concerning these exemptions is difficult of connotation, since some of the terms are obscure and unintelligible. I make an attempt here, rather with diffidence, to interpret these terms. My interpretation is, however, tentative. An exact translation of the whole passage concerning the immunities granted is given below.

"In this village the taxes due from the smith (lōhakāra), the cobbler (carmakāra), from those that grant licences (paṭṭa) for shops (āpaṇapaṭṭakāra), from those that deal in ropes (rajjuprati-hāra)—in other words those who measure fields and lands with ropes, that is to say, overseers—, from those that deal in blankets (prāvāraṇcara), and from those that live by shops (āpaṇājivika); and the (customary) dues (in the form of service or kind) from the ploughmen—peasants—(nāhalamukhadharaka), from those who show the place where good wells could be dug (kūpadarśaka), from weavers (tantuvāya), from gambling (dyūta), from marriage (vivāha), and from barbers (nāpita), and from all kinds of artisans (sarvaparīhārakārudēyāni—could it be Sarvaprakārakārudēyāni?) and all other dues to which I am entitled, are given to you, having been made brahmadēya."

or Kandāra, and Kandarapura, in ordinary parlance. If this identification of Tāmrapura with Kandāra, mentioned in the grants of the kings of Ānandagōtra is accepted, then the early Pallava power finally receded to the south from Tāmrāpasthāna, most probably owing to political conflict and successive aggression of the chiefs of Ānandagōtra. Kandarapura was mentioned in the Cējarla inscription also (*S.I.I.*, Vol. VI, No. 594).

53. The name of the village granted was read as Viḷuvatti grāma (*Vide, Ep. Rep.*, for 1934 p. 30, para 4). What I have taken to be *ḍhu* is taken to be the Tamil *ḷa* of the 5th century. However, some more instances are required to prove the case that a Tamil *ḷ* was used so early as the 5th century in the Telugu-Kanarese script. Until then I take the name of the village to be Viḍhuvatti grāma. In none of the early records, either lithic or copper plate, written in the Telugu-Kanarese script, have I found a Tamil *ḷa*. The Telugu-Kanarese script had a separate symbol for *ḷa*, which was different from Tamil *ḷa*.

Here some explanation seems to be necessary for my interpretation of the term *āpaṇapattakāra* as given above; *āpaṇapattakāra* is different from *āpaṇājīvika*; the former I have taken to mean those members of a trade guild, who are empowered to grant licences for shops. There are evidences to show that the merchants of the eighteen *nāḍus* or *samayas* formed themselves into corporate bodies, and carried on the trade and commerce of the country paying perhaps some amount to the ruler of the land periodically. The king never seems to have interfered in their internal affairs but gave them a *free hand to do as they liked*. Two instances⁵⁴ of this kind are furnished from the inscriptions of the Kākatīya period. The general body of the trade guild in these two instances entrusts some people with the business of killing some of its members who defy the rules and have thus become traitors to the *Samaya*—*Samaya-drōhins*—and confers on them some privileges for achieving the end. The king does not seem to have interfered or at any rate, no evidence has come to light that he did interfere in the matter. These instances help us to infer that the king, in times of yore, used to lease out the right of collecting taxes, tolls and other dues to the merchant-corporation or guild, probably to the highest bidder periodically. The corporation officers in their turn granted licences to those who set up business (shops) on payment of a fee. This state of things must have been in vogue even from early times as mention is made of various professional guilds in the records of the Śātavāhanas. On the strength of the instances cited above, I interpret the term *āpaṇapattakāra* as licensing officers, representing the corporate body of merchants. The meaning of “*prāvāraṇcara*” is not quite clear; “*prāvāra*” means an upper garment or mantle. I have taken “*prāvāraṇcara*” to mean those who deal in blankets. I am unable to offer a better interpretation. “*Rajjupratihāras*” may be the same as the *rajjukas* of the Aśōkan edicts. Perhaps they were private overseers and used to pay a profession tax to the king. Again the term “*nāhalamukhadharaka*” is baffling. This seems to be the correct form and not “*nāhalamukhaddhraka*” as is found in the text. Monier Williams gives the meaning of “*nāhala*” as a barbarian. Even then the meaning of that compound word is not clear. We may split the term “*nāhalamukhadharaka*” into “*nāhalamukha*” and “*dharaka*”—a money-lender. Yet the first part “*nāhalamukha*” makes no sense. As such “*nāhalamukhadharaka*” is

54. C.P. No. 11 of 1918-19; and C.P. No. 10 of 1918-19.

taken as a compound word. I have taken “*nāhala*” to be the Vikriti of “*lāngala*,” plough (“*lāngala-nāhala*—Telugu *nāgali*”) and thus interpreted “*nāhalamukhadharaka*” to mean a ploughman or a peasant.

The above passage brings to light a number of taxes and dues, due to the king from a village. It is significant that the exemptions mentioned in the Hirahadagalli plates⁵⁵ and the Maidavolu plates⁵⁶ of Śivaskandavarman are not mentioned in the grant under review.

55. *Ep. Ind.*, Vol. I, p. 2 ff.

56. *Ep. Ind.*, Vol. VI, p. 84 ff.

TEXT¹

FIRST PLATE

1. स्वस्ति [॥*] जितं भगवता [॥*] श्रीविजयपट्टकराधिष्ठाने परम ब्रह्मण्यस्य स्वा-
2. हुनिर्जिताजित²क्षात्रतपोनिधेः विधिविहितसर्वमन्यादा³ स्थितिस्थित-
3. स्यामितात्मनो महाराजस्य पृथिपीतलैकवीरस्य श्रीवीरवर्मणः प्रपो-
4. तस्यात्युच्चित⁴शक्तिसिद्धिसम्पन्नस्य प्रतापोपनतराजमण्डलस्य भग-

SECOND PLATE: 1st SIDE

5. वद्वक्तिसद्भावसम्भावितसर्वकल्याणस्यानेकगोहिरण्य भूम्यादिप्रदाने [ः*]
6. प्रवृत्तधर्मसंश्रयस्य प्रजापालनदक्षस्य लोकपालानाम्पञ्चमस्य महा-
7. त्मनो महाराजस्य श्रीस्कन्दवर्मणः पौत्रस्य देवद्विजगुरु वृद्धोपसेविनो वि-
8. वृद्धविनयस्यनेक संग्रामसाहसावमर्दोपलब्धविजययशःप्रकाशस्य

SECOND PLATE: 2nd SIDE

9. निरुपमात्मनो युवमहाराजस्य श्रीविष्णुगोपस्य पुत्रः कलियुगदोषा-
10. वसन्नधर्मोद्धरणे नित्यसन्नद्धः स्पृहणीयपराक्रमो राजविगुण स-
11. र्वसन्दोहविजिगीषुर्धर्मविजिगीषुर्भगवत्पादानुदघातो बप्पमट्टारकपाद-
12. भक्तः परमभागवतो भारद्वाजः स्विक्रमाक्रान्ता [न्य^{4a}] श्रीनिलयो यथावदाहता-

THIRD PLATE: 1st SIDE

13. नेकाश्वमेधयाजिनाम्पल्लवानाम्महाराजः श्रीसिंहवर्मा मुण्डराष्ट्रे विदु⁵वद्वि-
14. ग्रामे तस्यैव ग्रामस्य क्षेत्र⁶ सर्वाद्वयक्षांश्च तत्सञ्चारिणश्चाज्ञापयति अ-
15. यं ग्र (ग्रा) मः सम्राक⁷सर्वपरिहारोपेतो देवभोगहलवर्जं मस्यदायुर्व-
16. लविजयाभिवृद्धये समेषमानविजयराज्ये दशमे संवत्सरे श्रावण्यां शुक्लप-

1. From the original plates.

2. Read स्वाहु [बल*] निर्जितोर्जित.

3. Read सर्वमन्यादस्य स्थिति.

4. Read अत्युच्चितशक्ति

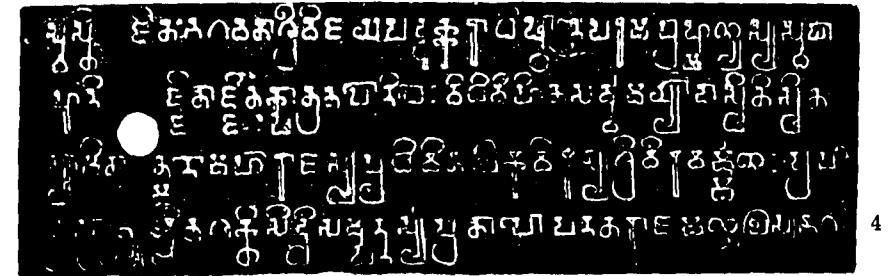
4a. The letter न्य is peculiarly and wrongly written. Read स्विक्रमाक्रान्ता⁸ यनृप [The reading may be स्विक्रमाक्रान्ताग्रश्री—Ed.]

5. See note 55 on page 155.

6. Read ग्रामस्य क्षेत्रद्वयक्षेत्र.

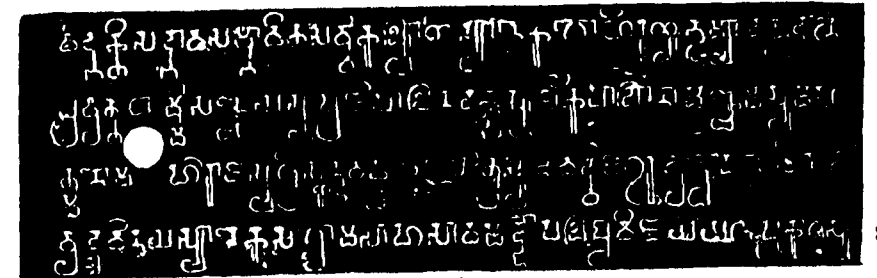
7. I think some letters in this word were omitted by mistake by the engraver. It should be सम्रा [मटि] क.

First plate:



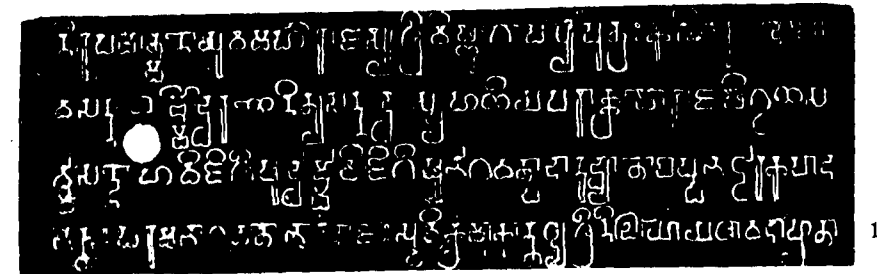
4

Second plate : 1st side



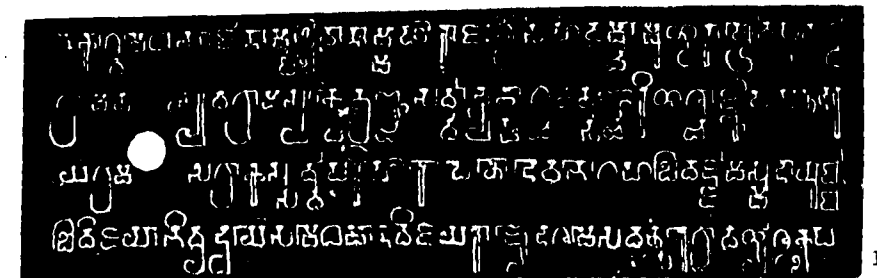
8

Second plate: 2nd side



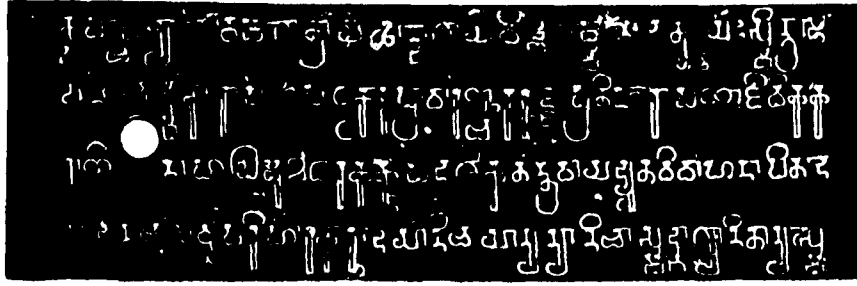
12

Third plate : 1st side



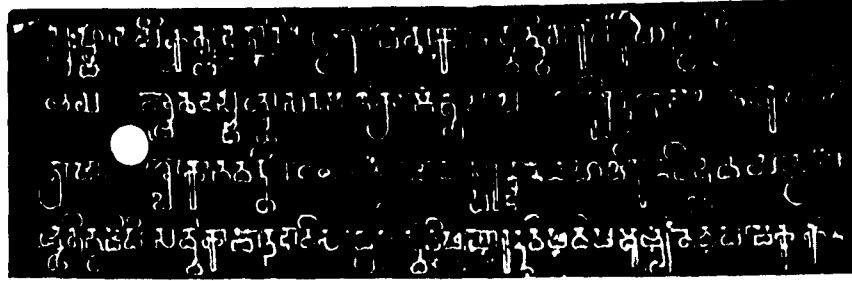
16

20



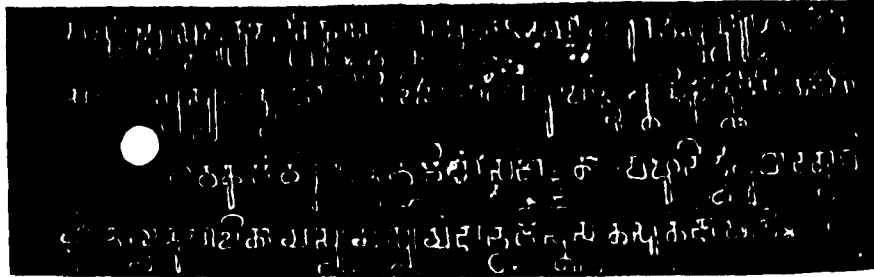
Fourth plate: 1st side

24



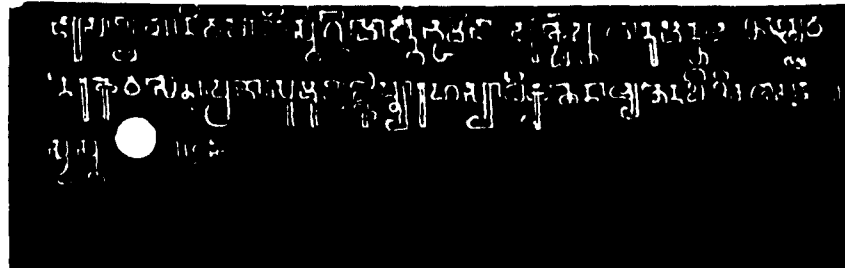
Fourth plate: 2nd side

28



Fifth plate:

30



THIRD PLATE: 2nd SIDE

17. क्षपञ्चम्यां गौतमगोत्राय ⁸छन्दोगाय विष्णुशर्मणे दत्तम्⁹ [||*] यदस्मिन्नामे
18. ¹⁰लोहचर्मकारापणपट्टकारप्रावारश्चर रज्जुप्रतिहारापणाजीविक-
19. राणि नाहलमुखधरकूपदर्शकतन्त्र (तु) वायुतैतविवाहनापितदे-
20. यादीनि च सर्वपरिहारकारुदेयानि च यान्यन्यानि चास्मद्भाग्यानि तान्यस्मै

FOURTH PLATE: 1st SIDE

21. ब्रह्मदेयीकृत्य दत्तानि [||*] वट्टग्रामेयकाः कुर्वन्वितरे परिह [र*] न्तु परिहारयन्तु
22. च [||*] यश्चैतदस्मच्छासनमतिक्रामेत्स पापः शरीरदण्डं मर्हति [||*] अपिचा-
23. त्राषा¹¹ श्लोका भवन्ति ॥००॥¹² भूमिदानात्परन्दानमिहलोके न विद्यते[||*]यः प्रय-
24. च्छति भूमि¹³ हि सर्वकामान्ददाति सः [||*] ब्रह्मस्वं [हि*] विषं घोरन्नविषं
विषमुच्यते [||*] विषमेकाकिनं

FOURTH PLATE: 2nd SIDE

25. हन्ति ब्रह्मस्वं पुत्रपौत्रिकं[||*]स्वदत्तां परदत्तां वा यो हरेत् वसुन्धराम्¹⁴[||*]गवां शत-
26. सहस्रस्य हन्तुः विबति¹⁵ किल्बिषम्¹⁶[||*] यथा निरोहन्त्युत्तानि कीर्णानि च मही
27. तले [||*] एवं कामा विरोहन्ति भूमिदानसमाज्जिता^{16a}[||*]बहुभिर्वसुधा दत्ता ब-
28. हुभिश्चानुपालिता [||*] यस्य यस्य यदा भूमिस्तस्य तस्य तदा फलम्¹⁸[||*]

FIFTH PLATE

29. असंख्येयानि वर्षाणि स्वर्गे मोदन्ति भूमिदाः[||*] आक्षेप्ता चानुमन्ता च तान्येव
30. नरके वसेत्¹⁷॥ प्रभोः सुमुखाज्ञाप्या¹⁸ रहस्याधिकृतेनाच्युतेन लिखितं शासनम्[||*]॥
31. स्वस्ति¹⁹ ॥ ० ॥

8. It seems the letter ⁸ was first wrongly written and then corrected.

9. Read दत्तः. The final ⁹ is written below the line.

10. See above for a tentative interpretation of these terms.

11. Read त्राषाः श्लोकाः.

12. This represents a punctuation mark.

13. Read भूमि हि.

14. Read वसुन्धराम्. The final ¹⁴ is written below the line.

15. Read विबति.

16. The final ¹⁶ is written below the line.

16a. Read समाज्जिताः.

17. The final ¹⁷ is written below the line.

18. Read सुमुखाज्ञाप्या.

19. Read स्वस्ति ॥

REVIEWS

SOME INFLUENCES THAT MADE THE BRITISH ADMINISTRATIVE SYSTEM IN INDIA. By M. Ruthnaswamy. Luzac and Co. Rs. 10 or 21 sh. net.

Mr. Ruthnaswamy has done us signal service in producing this pioneer work on the British Administrative system in India. The subject is vast, inchoate, intricate and has largely been unexplored. Books on the growth of government departments, the work of District Collectors, and the impulses of the administrative system are non-existent or at best scanty and inadequate. It was past time that this rich slice of Indian history and political science was cut and analysed; and no one was better equipped to do so than the distinguished author of this book. He was invited to deliver the Sir William Meyer Lectures for the year 1936-7, and he has now licked those lectures into the shape of a fat volume. It is true that the pristine purity of the infant has now grown into the awkward proportions of an adolescent; the chapters are of unequal length and the detail is unnecessary and inartistic; and the figleaf of footnotes has not been expanded into a decent cloak of index and bibliography. But it must be admitted at once that a new field of enquiry has been opened up and that one at least of the many gaps in our history has been stopped.

The difficulties of the author's task are clear. Any history of an administrative system must not only be a chronicle of the growth of institutions and practices but a picture of the social, economic and intellectual climate of the times under review. It is necessary to examine the political history; to evaluate the factors that went to the inception and formation of administrative agencies; to study the play and interplay of social and political ideas of the governors as well as the governed. The British system in India has been largely determined by the nature of its origins and the motive forces of its operation. It took over much of the organisation and conventions of its predecessors; it grew haphazardly and adapted itself to changing circumstances. There are some obvious factors such as commercial beginnings, the Army and its distribution, the Frontier and Land Revenue which have given the British system its peculiarities; but assuredly there are other ancillary factors which have been no less powerful: the political awakening in India, the growth of the Indian press, the rise of an Indian middle class, the new industrial and

labour problems. A book on the governmental system in British India should therefore investigate not only the direct factors but also the indirect and no less insistent features of our history.

Mr. Ruthnaswamy is however content to deal only with the former. He examines in great detail the commercial origins of the administrative system and their permanent effects. The designations of offices; the system of remunerations by low salaries and trade privileges replaced by relatively high salaries; the methods of recruitment of Officers; the influence of the dual government permeating the whole machinery; the Indian Navy and its work in the Marine Survey—all these are tracked down to commercial beginnings. A lot of interesting matter is tabulated and analysed; and the final judgment is fair and temperate: "As a government the company has a record as good as any government of those times." Similarly, the part of the Army in the creation and maintenance of the administrative system proves the theme of another chapter. The importance of the company's army in pre-conscription days, the power and prestige it commanded, the quasi-military character of government in conquered territories, the mutinous traditions of the company's forces, the uncontrolled and wasteful nature of military expenditure—all these are admirably dealt with and many new points are suggested. The role of army officers as agents in Indian States and as assessors of land revenue and the influence of the military on railway constructions are emphasized in detail. There is also sound criticism of Army administration. The Army, it is pointed out, continues to be the white elephant of Indian finance. Its constitutional position even under the Acts of 1919 and 1935 is still what it was before. The saying of Sir Charles Trevelyan that if the State does not control the military expenditure the military expenditure will control the State is recalled with added point. "The Indian Army was more popular and national before the Sepoy Mutiny than it has been after. . . . The divorce between the citizen and soldier that has thus resulted can never be a source of strength to any State."

The chapter on Land Revenue is the longest and perhaps the most interesting. The three main systems of land revenue—the Zamindari, Ryotwari and the Mahalwari—are discussed at length. The tenancy acts of the zamindari areas, the lawlessness of the zamindars and the place of the old Revenue officials in the new system are clearly set forth. Inams and their effects on finance are briefly reviewed and the resumption of Inams approved. It is shown that the ryotwari system estab-

lishes and maintains more intimate contacts between the governments and the people than other systems are capable of doing; and the opportunities it affords therefore for corruption are fully described. It is also shown how the size of the district and the functions of the district officials are determined by the nature of the land revenue system.

On the other hand, some of the author's judgments are difficult to understand and a little obscure. We are told that the company brought commerce and constitutional government to India and that the commerce of India was largely inland till the company came. Monopoly and Investment were the warp and woof of the company's administration, but surely this is an overstatement: "The necessity of remitting home in goods of £3,200,000 as late as the middle of the 19th century made the Government of India under the company mercantile till almost its last days" (p. 10). Surely, the change of emphasis from commerce to administration for purposes other than commercial took place as early as the time of Lord Cornwallis. Again, in 1781, we are told, "Parliament fixed the payments to be made by the company for the Royal troops that it employed," and this is mentioned to prove the theory that the commercial character of the company led to the defraying of all charges in India and in England from the Indian revenues. But it must be recalled that Parliament at that date was making similar demands on the American Colonies. Much of the slow Indianization of services, the system of Government by means of Councils and Boards, and the position of the secretary in Indian governments are traced to the commercial origins of the British system; but there seems little justification for doing so. Moreover, some statements are apt to strike one as curious. For example about the Survey of India: "By the work it did in the delimitation of its political boundaries.....it gave edge and definition to the patriots' love of the land of India. . . In their lonely wanderings, in forest swamp and deserts, beset by malaria and the fear of wild beasts, with their triangles and sub-triangles, their series, base lines and arcs, the Officers of the Survey of India have contributed not a little to the political unification of India" (pp. 195-6). Or this: The Bazaar was a creation of the army, "born in the wake of the company's armies on the march." Or again, "Land revenue keeps the villages alive" in the sense "that they were originally petty self-sufficient atomistic republics. By Land Revenue and its administration they have become cells in the body of the state deriving life from and imparting life to the body

politic (p. 354)." Or still again, "It is land revenue that has taught large masses of people the practice of political obedience" (p. 383).

But it is the chapter entitled the hold of the frontier as a decisive influence in moulding the administrative system that is most difficult to grasp: "The Indian frontier has ever been victorious in its influence on India." "The Frontier seems to be a thing apart, a thing existing in itself and for itself." The influence of the Frontier is clear on the distribution and composition of the army and the inevitable "Punjabisation" of the government of India in some respects. But to argue from this that the Frontier has played a significant part on the civil administration of the country is to view things out of proportion. Again, to contend that "the defence of the frontier has brought the Indian States and British India together" (p. 465), or that "the policy of finding a frontier for India in Afghanistan if it had succeeded would have postponed *sine die* the consolidation of the sense of Indian unity" is far-fetched and unconvincing. The Frontier has always been something alien to Indian politics and it exists to a large extent because of the nature of the authority in India. It is in no sense a force in Indian nationalism nor in the Indian administrative system.

Finally, the chapters on the State made by the Administrative and the social and political ideas forged by the Administration are disappointing. They contain mostly reviews of the history of government departments; of the relations of the Government with the Indian States; the role of treaties; the abolition of slavery, Begari infanticide, Sati and so on; the civilisation of backward tracts; and a few remarks on Individualism, the progress of self-government and the paternalism of the Indian government. These chapters could have been made the most absorbing if the author had examined the political and other writings of Indian publicists during the times under review; if he had studied the growth of the Indian press, especially the vernacular press; if he had shown how the political awakening took various forms and how it affected various groups and provinces; and finally, if he had turned his attention to the growing problems of industry and labour, the effects of world trade on the Indian agriculturists and the efforts made by the administrative system to take account of the upsurge of new ideas and new facts of economic life. It is obviously impossible to do justice to this aspect of the subject but an attempt to state even the outline would have been invaluable. Let us hope that

Mr. Ruthnaswamy will turn his zeal and labour to this new field and produce a companion volume on "some more influences that made the British Administrative system in India." Few scholars are better qualified and fewer still have achieved his distinction in public life.

D. S.

A HIGHER SCHOOL CERTIFICATE INORGANIC CHEMISTRY
by E. J. HOLMYARD—xii, 529 pp. J. M. Dent & Sons, Ltd.,
London—1939.

The name of Holmyard must be familiar to the Chemistry teachers of the present day. His association in the writing of any Science book insures a guarantee of authentic scholarship and of humanistic and masterly exposition of its subject matter. The book under review has been written by Holmyard with a definite purpose for Higher Certificate classes and his impress is in evidence in all its pages.

The author explains in the preface his competency to write this purposive book and refers to the factors that have limited its scope and function. It is refreshing to note that, though the allotment of space to individual topics is roughly in proportion to the frequency with which those topics have appeared in the examination papers, the author, as would be expected of him, has not sacrificed the cultural aspect of Chemistry which is seldom reflected in examinations and which should "receive due attention in a book which aspires to do something more than a cram." Furthermore, the topics are dealt with in such limits as will enable the prospective examinees to reproduce them or their substance in half an hour; for, his examining experience, which coincides with that of others in the field, shows that "large numbers of candidates suffer from an inability to extract the gist of a subject and therefore write answers both diffuse and disproportioned." A knowledge of School Certificate Chemistry is assumed on the part of the readers of this book and therefore information up to that level has been omitted or only briefly recapitulated. Practical details for experiments are not included in it. Such are the limiting features of the book. Nevertheless, it contains sufficient general, theoretical, physical and descriptive Chemistry which will be useful to University students as well.

Part I contains 16 chapters which deal with Theoretical and Physical Chemistry in 177 pages. The matter is thoroughly up-to-date. Atomic Structure, Valency, the Colloidal State, the Phase

Rule, Ionic theory and its applications, Strong Electrolytes, Mass Action, and Catalysis are some of the topics which have been very brightly and lucidly explained. Many numerical problems are also worked out.

Part II contains descriptive matter about the common elements and their compounds dealt with in 12 chapters of 330 pages according to the well-known scheme of the Periodic Classification. Every chapter is accompanied by comparative exercises, and tests for identifying metals in their compounds are given in the appropriate places. There are numerous cross references. The text is remarkably free from errors. An index of 13 pages completes the book. There are 95 illustrations composed of clear-cut line diagrams and portraits of eminent Scientists. A word of praise is due to the Publishers for the attractive format in which the worthy text of the book is clothed.

A few instances of personal and human element in the book are cited:—(a) "The author may be excused for mentioning that, with great generosity, Professor Travers has presented a discharge tube containing some of the original specimen of Neon to the Clifton College Science Department." (p. 183); (b) "Unfortunately the Portland vase was smashed by a lunatic in 1845 but it has been so deftly reassembled that much of its pristine beauty remains." (p. 319); (c) "The explanation will however satisfy those kindly souls, the Higher Certificate Examiners!" (p. 411); (d) "It is credibly stated that hens dosed with Iodine lay more eggs, cattle yield more milk and sheep produce more wool" (p. 480); and (e) "A periodic phenomenon is one which is repeated at intervals, e.g., the appearance of the *Punch* on Wednesday" (p. 156).

Obsolete methods are either omitted or only casually mentioned in the book. One would search in vain for a reference in it to Le Blanc and his century-famous method of manufacturing washing soda (though this is religiously and elaborately explained even now to the students in the colleges of our University). Similarly a foot-note on page 222 says that in older, somewhat grotesque, process, known as poling, is nearly, if not quite, obsolete. Again on page 457 one finds that the old Weldon Process is now obsolete and the Deacon Process also is obsolete or practically so.

India, as the second largest producer of iron ore in the British empire, and ninth in the world, might have been mentioned along with the other countries containing rich iron fields (p. 493). It is curious to note that the use of Chlorine as a poison gas is not mentioned among its uses on p. 461. Instead of saying that Chlorine is used

"indirectly in the commercial hydrolysis of wood to dextrose (grape sugar)," it would be more true to say that nearly 40 per cent Concentrated Hydrochloric Acid is used in the Commercial hydrolysis of wood. In the index, under the heading Allotropy on p. 517, references to pages 295 and 424 relating to Carbon and Sulphur might have also been included.

The reviewer can, with confidence, recommend this book on Chemistry to the Pass students of Indian Universities and they will learn, with pleasure and profit, the modern tendencies in Chemical thoughts and processes.

K. C. V.

THE GRAMMAR OF SOUTH INDIAN MUSIC, by C. Subrahmanya Ayyar, B.A., 1939.

Mr. Subrahmanya Ayyar is well known in South Indian musical circles, for his keen interest in the problems of Indian music, and his various contributions, based on individual experience and experiment, to the problem of the actual pitches in which several swaras occur in South Indian Rāgas. It is with very great pleasure that we welcome this book from his pen, embodying the conclusions of years of thought and research, in a field which bristles with peculiar difficulties.

The first chapter gives a thorough treatment of the whole question of the genesis and the number of śrutis. This chapter will be specially helpful to all students of Indian music, as a clear exposition and presentation of a topic which can properly be named the Asses' Bridge of Indian Music. To explain the generation of the Śrutis, Mr. Ayyar takes as guiding principles, firstly, the generation by proceeding by intervals of a fourth or fifth from the tonic, and reducing the notes so obtained to the fundamental octave, and secondly the fact that the same frets produce notes on the Sa and Pa strings of the Viṇā. He thus obtains twenty-four śrutis, of which two are discarded as being too close to the śaḍja and paṇchama, thereby giving the twenty-two classical śrutis. This according to the author is an indispensable preliminary method of constructing the Śrutis; in later chapters, the author discards this method as unsuitable, as it produces complex relative frequencies which do not occur in our music, and proposes certain fairly simple ratios for the relative frequencies of the twenty-two śrutis, some of which he admits not having been able to verify with his present facilities. He has also mentioned three simple ratios, 8/7, 12/7,

11/6 which do not come within the 22 śrutis proposed by him. Mr. Ayyar offers the suggestion that 11/6 lying between Kaiśiki Nishāda 9/5 and Kākalī Nishāda 15/8 may be the Nishāda of Begaḍa. In support of this suggestion he offers the plausible argument, that the ear shows that the relation of Śaḍja to Nishāda in Begaḍa is the same as that between Paṇchama and Madhyama. Since the author's (unverified) value for 'Tivra Madhyama' is 11/8, the value for the Nishāda is accordingly 11/6, since

$$11/8 : 3/2 = 11/6 : 2.$$

This and many other similar identifications of relative frequencies of various Rāga-notes (for example of Surattī Nishādam as 7/4), effected through experiment or more or less plausible reasoning, form a rich mass of exceedingly interesting and original material, for which musical students and scholars will feel greatly indebted to the author. The book is calculated to provoke thought and research, and it is to be hoped that the values and identifications advanced by the author will receive independent confirmation.

The reader does not feel equally happy in those portions of the book which deal with individual Rāgas. The author generally inclines to the view, characteristic of the instrumentalist, that all problems relating to the Rāga reduce in the last instance to the śrutis occurring or not occurring in them. On the other hand, the fact is that there is a certain latitude in the śrutis in which a particular swara can occur in a rāga; therefore though certain śrutis may be significant in a rāga yet the rāga cannot be completely characterised by them, but only by its typical gamakas and movements. Thus it is one of the classical problems of Carnatic music to characterise the difference between Kalyāṇi and Śankarabharanam in the portions of the octave other than the Madhyamam—a problem which is also dealt with by the author, though not in a particularly happy or illuminating manner. In characterising the difference, one must of course necessarily refer to the difference in the śrutis of particular notes as they *generally* occur in the two rāgas; but even more important is the difference in the favourite types of gamakas and movements of the two rāgas. Incidentally I may say that I believe the author's account of the difference in the Gāndhāras and Nishādas of the two rāgas to be quite wrong.

As an example of the fact that the search for the specific śrutis may not lead us very far in understanding a Rāga, we may mention the case of the Oḍḍava rāgas studied by the author. The *crude* fact that the rāgas Mohana, Śuddha Sāvēri, Hindola, Madhyamāvati form a cycle in the sense that their Arohaṇāvarohaṇas are obtained

from each other by change of tonic is well-known. But the characteristic śruti relationships, the nature and quality of their gamakas are so utterly different and individual, that the crude relationship of the rāgas explains *nothing* whatever regarding either the individual quality or the mutual relationship between the Rāgas. Indeed, if a person A is singing, say, Mohanam, and if a second person B hears it with a different tonic in his mind, he does *not* get the impression of one of the other rāgas of the cycle. Thus the crude relationship is not significant as it accounts for nothing, and therefore does not deserve to be mentioned at all, except apologetically.

In his list of rāgas, the author has put down Mohanam as a Janya of both Śankarābharanam and Harikāmbodi. It is not quite clear whether this is done on his own authority or on the authority of the Music Academy. On whosoever authority it has been done, it must be emphatically asserted that *whoever has not succeeded in understanding that Mohanam is not a janya of Śankarābharanam or Harikāmbodi but of Kalyāṇi does not possess the key to Carnatic Music.*

R. VAIDYANATHASWAMY.

THE MELA-RĀGA-MĀLIKA OF MAHĀ VAIDYANĀTHA ŚIVAN. Edited by Pandit S. Subrahmanya Sastri; The Adyar Library, 1937.

Recently the Adyar Society published under the able editorship of Pandit S. Subrahmanya Sastri, the Saṅgraha-Cūḍamaṇi of Govinda. The publication of the Rāga-Mālikā of Mahā Vaidyanātha Śivan in the Mela-kartas of Govinda's Scheme is an appropriate sequel to the Saṅgraha Cūḍamaṇi. The get-up is excellent and the printing of musical part leaves nothing to be desired. There is a brief life-sketch of Mahā Vaidyanātha Śivan adapted from Mahā-mahopādhyāya Swaminatha Ayyar's biography and a musical introduction written with meticulous care, containing thorough and fool-proof explanations of the Melakarta system of Venkaṭamakhi and its adaptations by Govinda. The book is therefore a desirable acquisition to music-lovers interested in the personalities of Carnatic Music. A photograph of the famous musician in the frontispiece adds greatly to the value of the publication.

The merits of Govinda's scheme have been the subject of controversy in the press among the reviewers of Saṅgraha Cūḍamaṇi. The deeply thought-out and carefully planned Mela-kartā idea of

Venkaṭamakhi effected a revolution in the musical outlook and opened out endless vistas of development. The characteristic feature of his work and the hall-mark of its real greatness is that though combinations of swaras are the means used in arriving at Mela-kartas, yet the classification was throughout guided by the intuition of true musical values, namely of those expressive elements of the Rāga without which the Rāga would cease to be itself. Hence it is, that there is an attempt to specify the Rāga through the precise śrutis of its notes, over and above the Ārohaṇāvarohaṇa; hence also the distinction between Bhashāṅga and Upāṅga Rāgas. Hence again, the idea that the Mela-kartā should not be a scale, but itself a Rāga—evidently, on the ground that a Rāga can never be produced from a mere combination of swaras in the form of a scale, but only from a Rāga. This explains why Venkaṭamakhi's Melakartās have been chosen wherever possible from well-known Rāgas, in which the notes occur in standardised śrutis. Lastly Venkaṭamakhi's discovery and treatment of the non-melodious combinations *ra ga, ru gu* etc. are very characteristic, and display a keen intuition of musical values. There can be little doubt that Venkaṭamakhi was led in the first instance to admit these combinations, in order to account for certain current Rāgas (of the type of Nāṭṭai), and obtained also the clue to the Prayoga of these combinations, from the suggestions available in such Rāgas.

And all these significant features of Venkaṭamakhi's theory are swept off at one stroke by a certain unknown man, Govinda, who claims to 'improve' upon the Venkaṭamakhi system, by converting the Melakartas into scales, with new names (not always in accordance with the Kaṭapayādi rules) and exhibiting Venkaṭamakhi's melakartas as janyas of these scales! In other words, Govinda has rushed in and done the obvious thing which Venkaṭamakhi was at such pains to avoid doing. And now there are two rival 'Melakartā Schools' of Venkaṭamakhi and of Govinda, the protagonists of the latter disclaiming all intentions of attacking Venkaṭamakhi or of subverting his views, but merely pleading for a tolerant consideration of Govinda's alternative views! It is indeed a veritable triumph for Govinda; and a situation more thoroughly ridiculous can hardly be imagined.

In the Govinda scheme every Melakartā is a scale and is also called a Rāgā, and it follows by implication that every Rāga is a scale, that is, an Ārohaṇāvarohaṇa. Therefore the real issue between the Venkaṭamakhi scheme and the Govinda scheme (or rather the scheme avoided by Venkaṭamakhi) is concerned with the question of what the Rāga should be. The Rāga is a unique ex-

pressive form evolved in Indian Music, and it goes without saying that every supporter of the Venkaṭamakhi scheme would be upholding the value of the Rāga as the ideal to be striven after and realised and that toleration of the Govinda scheme would be a vital encouragement of musical retrogression and degeneration.

The following-up of the Sangraha Cūḍāmaṇi by the publication of Mahā Vaidyanātha Śivan's Rāgamālikā would suggest that the idea was not entirely absent in the minds of the publishers, of buttressing the claims of the Govinda scheme by the pillar of Mahā-Vaidyanātha Śivan's musical reputation. The reviewer feels very doubtful whether the publication will advance this purpose. Indeed I have heard it said by a Tanjore musician that the Sangraha Cūḍāmaṇi was chosen by Mahā Vaidyanātha Śivan, because the Caturdaṇḍiprakāśikā had been removed from the Tanjore library. But even if he had chosen Govinda's work deliberately, that would prove nothing. For it is a matter of common experience that the great musical artist is not usually a good theorist or critic. Indeed the average musician is quite impartial in considering all musical doctrines backed by manuscripts to be Śāstra and inviolable and is not in the least worried if they happen to be mutually opposed. We have no evidence whatever that Mahā Vaidyanātha Śivan, possessor of an extraordinary voice as he was, was above the average in this regard.

The Rāgamālikā before us was not itself a composition inspired by an inner creative urge; it was a task executed to order. There can of course be no two opinions about the propriety of Mahā-Vaidyanātha Śivan's taking up the musical challenge set to him, and about his meriting the reward thereof (which I am informed, was Rs. 2,000). Musicians must live and princes must pay. But it is very doubtful whether this Rāgamālikā is calculated to enhance Śivan's reputation in the eyes of posterity. It is mechanical and uninspiring, particularly in those Melakartas on which one would like enlightenment. It gives the impression of avoiding difficulties, rather than revealing the way to surmount them, particularly in the Melakartas involving the non-melodic combinations. In short, the Rāgamālikā seems to prove thoroughly that Melakartas are nothing more than scales, and can have no particular value in a musical system in which the supreme value is the Rāga. Possibly the magic of Śivan's voice might have lent the Rāgamālikā a deceptive glamour in the Tanjore court. The publication to-day of the Rāgamālikā seems to have value as a musical curiosity of historical and anecdotal interest, rather than as contribution to music.

R. V.

CONQUEST OF SORROW. By Swami Sachidananda; Calcutta, K. L. Baser, 43, Badan Roy Lane, Beliaghata; pp. 58; price annas ten.

Swami Sachidananda, moved by a desire to console the afflicted and the sorrowful, has made public this sincere and straightforward outpouring of his vigorous optimism. It seeks to instil courage and persistence, in the face of emotional disturbances which are characteristic not of enduring substance, but of fleeting relations. Emotions have to be rationalised, i.e., transcended in the search for the higher, inner and truer self. Turning one's mind within away from the pursuit of the external, man may rise to be god-man and thus subjugate sorrow. In the process the disciplines and subsidiaries taught by sages like Patañjali will prove of considerable aid; the need for a guru should not also be forgotten. Sorrow leads to its own conquest by stimulating spiritual endeavour in the said manner and with the said accessories.

The book makes uplifting reading. The idea of transcendence or sublimation in place of annihilation is very valuable; for nothing can be really annihilated without reappearing in another form. But the notion that death is mukti (p. 23) is neither intelligible nor worth while. In spite of the taking over of Sāṅkhya concepts, manas is not distinguished from buddhi. And some śruti texts like Kaṭha, I-iii-4 are misunderstood, since Ātmā there means the body, not the Self. In spite of such blemishes, the work is calculated to awaken interest and stimulate inquiry in all except those who have finally given way to dull despair.

S. S. S.

THIS ENGLAND 1485-1714. By I. Tenen, M.A. Published by Messrs. Macmillan & Co., Ltd., 1939. Pp. 278.

There are already many Junior Histories available, but the author's defence for adding to their number is that he has "tried to do in this book, what, as far as he is aware, has not yet been attempted in quite the same way." In this book the narrative has often been interrupted for the treatment of social, economic and technical topics. Each chapter ends with a few very good exercises to test the intelligence and powers of observation of the pupils. The book is well written and is profusely illustrated.

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Tenth edition, revised, 1939—Information Section, League of Nations, Geneva. Pp. 359. Price 1sh.

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