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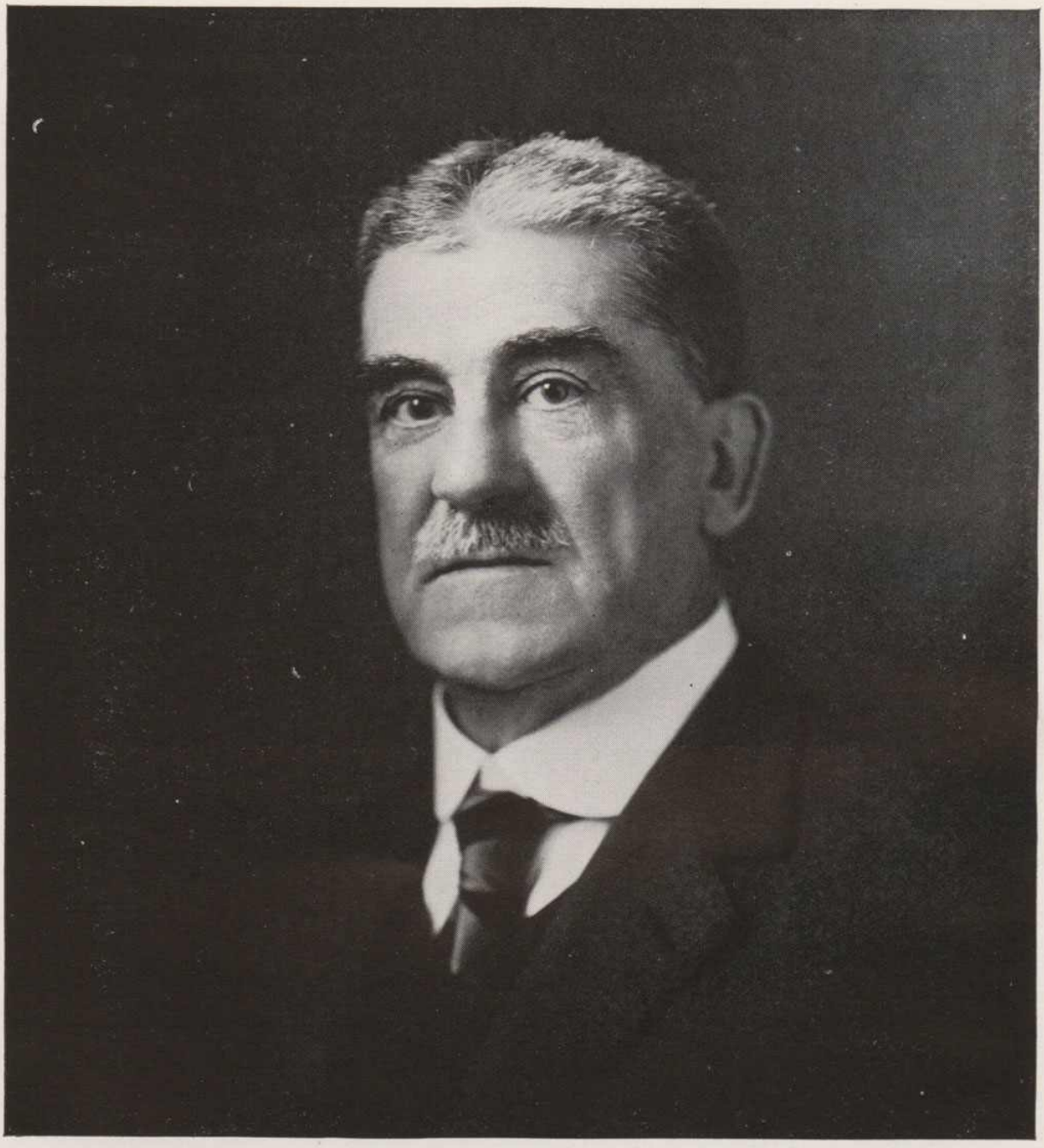


Charles R. Lanman
Professor of Sanskrit
Harvard University

TO

CHARLES ROCKWELL LANMAN

Wales Professor of Sanskrit at Harvard University; Corresponding Member of the Académie des Inscriptions et Belles-Lettres of the Institute of France, of the Russian Academy of Sciences, of the Society of Sciences at Göttingen, etc., etc.

THIS NUMBER
IS RESPECTFULLY DEDICATED
ON THE OCCASION
OF HIS
EIGHTIETH BIRTHDAY

PROFESSOR CHARLES ROCKWELL LANMAN AND HIS WORK IN THE FIELD OF INDOLOGY

By GEORGES DE ROERICH

THE second half of the last century saw an unparalleled growth of Indological studies. America and Europe competed with one another in the study of India's most gorgeous antiquity, and of her greatest treasure—her ancient literary language, the richness and structural features of which are absolutely unique.

Rudolph Roth in Tübingen, Böhtlingk in St. Petersburg, and Weber in Berlin influenced greatly the development of Indology, and masterfully renovated the critical study of the Vedas. The great, and as yet unsurpassed monument of the scientific activity of this brilliant school is the *Petersburger Sanskrit-Wörterbuch, Grosse Ausgabe*, compiled by Böhtlingk and Roth, and published by the Imperial Russian Academy of Sciences between 1852 and 1875. The introduction to the dictionary gives a lucid exposition of the views of the compilers; notwithstanding criticism by various authors, Goldstücker, Oldenberg and others, it remains certain that Roth is the founder of Vedic philology.

In America we see the eminent W. D. Whitney, inaugurator of an illustrious line of scholars, who made America's contribution in the field of Vedic research outstanding.

To this brilliant array of savants belongs the name of Charles Rockwell Lanman. For more than fifty years his work has been the stronghold of Oriental and linguistic studies in America, and many are the scholars who are proud to be his pupils and to have profited by his always friendly advice.

After his graduation from Yale in 1871, where he studied Greek under Hadley, and Sanskrit under Whitney, followed three years of study under Roth in Tübingen, Weber in Berlin, Curtius and Leskien in Leipzig. These were years of strenuous labor. The Veda classes of Roth, and the comparative grammar lessons of Leskien, left an indelible impression on the young scholar, and traced the path of future studies in these fields.

On his return to America, Lanman was called to Johns Hopkins University to teach Sanskrit, where he remained as Associate-Professor of Sanskrit from 1876 to 1880.

In 1880 came the call to Harvard, and with his advent Sanskrit studies at Harvard received a new impetus. It was during his occupancy of the Sanskrit chair, that Harvard became one of the leading centers of Indological studies.

In the same year Lanman published a learned monograph on the "Noun-Inflection in the Vedas" (*Journal of the American Oriental Society*, Vol. X, pp. 325-600), which remains an indispensable instrument of work for every Vedic student and an outstanding example of linguistic acumen. The vast amount of knowledge, the rigorous method and sound scholarship incorporated in this publication, placed the author in the foremost ranks of contemporary Vedic scholars.

In 1884 appeared his *Sanskrit Reader*, with vocabulary and copious notes. This remarkable book had eight editions, the latest being that of 1927. From the day of its publication, the *Sanskrit Reader* has been justly acclaimed as the best of the existing chrestomathies, for it not only gives a representative selection of great masterpieces of Indian literature, but offers first-class philological training, and as such is the guide-book of every Sanskrit student. The "Introduction to the Extracts of the Vedic Literature" (*Sanskrit Reader*, pp. 352 ff.) can be taken as an enunciation of the author's views on the Veda in general, and on the principles of its critical study and interpretation. Lanman was always an inspiring teacher, and accomplished wonders in guiding his pupils. The vast material brought together and commented upon in his "Notes to the Reader" bear testimony to his continuous and unselfish efforts to facilitate and encourage the study of Sanskrit, for he believed that Sanskrit serves best to reveal the fundamental principles which underlie the structure of English, Greek and Latin.

In 1889 Lanman, accompanied by Mrs. Lanman, undertook an extensive journey to India. In those days it was a totally new departure, and Lanman says in his "Presidential Address to the American Oriental Society" (JAOS, 1920, Vol. 40, p. 234): "When I was a graduate student at Yale, it was not even suggested that I should go to India; and an occasional letter of scientific interest from India was deemed worthy of publication in Weber's *Indische Studien* or in our *Journal*." As a result of this journey, Lanman brought back more than 500 valuable manuscripts in Sanskrit and Prākrit, which form the bulk of the Harvard Library Collection of Indian manuscripts. The journey to India gave the scholar unique and first-hand knowledge of Indian life, which was always so evident in his explanations of Sanskrit or Pāli texts in his classes. Indeed it is Professor Lanman's idea that all future Indianists should spend several years in India and master one of the more important vernaculars of modern India (such as Hindī, Bengālī or Marathī), and in his "Presidential Address" he states: "Increased opportunities will bring, as always, increased obligations, and for professed Indianists in America a period of residence and study in India—preferably, perhaps, at such places as Poona or Benares will become rather a matter of course" (*ibid.*, p. 235). This has since been an accepted part of the curriculum with every Indianist, for it is increasingly observed that a residence in the country and close contact with its ancient native science, benefits the scholar tremendously, and gives

him an inside knowledge of things that have a different aspect in Paris, London or Berlin.

Professor Lanman's greatest achievement in editing Indian texts is his *Harvard Oriental Series,* which was started in 1891 and of which 32 volumes have been published. This monumental series, which as an example of scholarly edition and editorial skill stands unparalleled, was founded by Professor Lanman and endowed by his pupil and friend, Henry Clarke Warren, himself a distinguished Pāli scholar and author of *Buddhism in Translations,* published as the third volume of the *Harvard Oriental Series* (first published in 1896, 8th edition in 1922). The aim of the series is "to make available to the West good Indian texts and good English translations thereof." It is enough to look over each volume of the series, to see how much it owes to the Editor, and what an indelible impression is left by his scholarship on every text published in the series.

The first volume of the series, by the late Professor Hendrik Kern, is an edition of the Sanskrit text of the *Jātaka-Mālā,* by Ārya Çūra (*ca.* VIIth century A. D.) The second volume is contributed by Professor Richard Garbe, and contains the important text of the *Sānkhya-Pravachana-Bhāshya,* by Vijñāna Bhikshu.

Volume 4 is contributed by Dr. Sten Konow and Professor C. R. Lanman. It contains the Prākrit text of the drama *Karpūra-Mañjarī,* by the poet Rājaçekhara (*ca.* Xth century A. D.). The Prākrit text edited by Sten Konow, is followed by an English translation by Lanman, with introduction and notes.

Volumes 7 and 8 contain the great edition of the *Atharva-Veda,* translated, with critical and exegetical commentary, by W. D. Whitney. This great work was left unfinished by the eminent American Sanskritist, and was revised, edited and brought nearer to completion by Professor C. R. Lanman. These volumes are a masterpiece of text-edition, and a fitting memorial to the collaboration of the two eminent scholars, teacher and pupil. The translation and commentary which in general is characteristic of the Whitney school, takes into account the works of the new movement in Vedic studies started by Pischel and Geldner. About this edition of the *Atharva-Veda* it has been justly said: "Few texts of antiquity have been issued with appurtenant critical material of so large a scope. And never before or since has the material for the critical study of an extensive Vedic text been so comprehensively and systematically gathered, and from so multifarious sources, nor presented, with masterly accuracy, in so well-digested form."

Volume 10 contains the great *Vedic Concordance* by the late Professor Maurice Bloomfield. This large volume in royal quarto is a mine of information and an enduring monument to the industry and learning of the American school of Sanskritists.

The four following volumes of the series are by Professor Johannes Hertel, who contributes a critical edition of the *Pañchatantra*. Professor Lanman has added an important essay to the eleventh volume, on the "Externals of Indian Books."

Volume 15 contains the German translation of the *Kirātā-rjunīya*, by Professor Carl Cappeller.

Pischel contributes a critical edition of the Bengālī recension of Kālidāsa's *Çakuntalā* (Vol. 16 of the series).

Volume 17 contains a translation by Professor James H. Woods of the *Yoga-sūtras* of Patañjali.

Professor Arthur B. Keith contributed a number of important volumes to the series: *The Veda of the Black Yajus School* (Vols. 18 and 19); *Rig-Veda Brāhmanas* (Vol. 25); and the excellent *Religion and Philosophy of the Veda and Upanishads* (Vols. 31 and 32, 1925).

Volumes 20 and 24 contain another important work for the critical study of the Veda by the late Professor Bloomfield—*The Rig-Veda Repetitions.*

Volumes 21, 22 and 23 contain a critical edition of the *Uttara-Rāma-charita* by the poet Bhavabhūti, in the original Sanskrit and Prākit, with notes and translation by Dr. S. K. Belvalkar, a pupil of Professor Lanman, and professor of Sanskrit at Poona.

Professor F. Edgerton contributes a critical edition of the Sanskrit versions of the *Vikrama-charita,* and an English translation of the text (Vols. 26 and 27).

Volumes 28, 29 and 30 contain a translation of the *Dhamma-padaṭṭhakathā* by Mr. E. Burlingame, a pupil of Professor Lanman.

We give the above survey of the published volumes of the *Harvard Oriental Series,* in order to show the scope and the great variety of Indian texts published in the series. It is a fitting memorial to the coöperation of a brilliant line of scholars, made possible thanks to the learning, the industry and the untiring zeal of Professor Lanman, and the enlightened foresight of the late Henry Clarke Warren.

Work on the series continues with unabated energy, and a representative list of important volumes is scheduled to follow those now in print. During my visit to Cambridge, Massachusetts, in the winter of 1929-30, I found the eminent scholar and editor hard at work on the edition of Geldner's translation of the *Rig-Veda.* This new venture of the *Harvard Oriental Series* will occupy fully four volumes, and will represent an outstanding contribution to the already very extensive literature on the Veda. All previous editions and translations of the *Rig-Veda* were clumsily edited, and present numerous drawbacks as scholarly editions; this new Geldner-

Lanman edition of the *Veda of Praise* will, no doubt, remedy the situation and furnish us with a first-class translation, with the necessary historical and critical commentary. The lamented death of Professor K. Geldner will somewhat delay the publication of the work.

Lanman has rendered great services in the study and editing of Buddhist texts. He inspired Mr. Simon Hewavitarne, of Colombo, in the latter's plan of publishing a complete text of the Buddhist sacred books in Cingalese characters. For many years he has worked on a critical edition and translation of Buddhaghosa's *Visuddhi Magga,* this most important and most difficult of Pāli Buddhist texts. In connection with this work, Lanman published in 1913 an illuminating article in the *Proceedings of the American Academy of Arts and Sciences* (Vol. XLIX, No. 3, pp. 149-169), called: "Buddhaghosa's Treatise on Buddhism, entitled the Way of Salvation: Analysis of Part I, On Morality." This article contains a careful and detailed analysis of the first book on Morality (*sīla*). Let us hope that this edition and translation may be included in the *Harvard Oriental Series.* The teaching of Pāli and the principles of text-criticism of Pāli manuscripts always occupied a prominent place in Professor Lanman's university courses.

In addition to the many activities already referred to, Professor Lanman has published a number of books destined to assist the student in his studies of Sanskrit. His *Sanskrit Reader* was mentioned above; besides this important work, Lanman has also published *Parts of Nala and Hitopadesha in English Letters,* Harvard, 1889. *Bhāratan Readings* and *The Indic Alphabet called Nāgarī* are in preparation and will be published by the Harvard University Press. Of great importance will be his *Sanskrit Grammar,* which will help the student to master Sanskrit more comprehensively and at the same time keep in mind the position of the language in relation to the other idioms of the Indo-European family of languages. This book will be the fruit of more than fifty years of labor in the field of Sanskrit by a great teacher and master of the language, and as such will have a lasting place in the literature on the subject. Such a grammar was long a *desideratum,* and will, no doubt, help to revive Sanskrit studies in American and European universities.

Besides these extensive works, Professor Lanman has published numerous articles in scientific journals and magazines on questions of Indian linguistics, literature and religion: "Phrase-words and Phrase-derivatives", (JAOS, Vol. 40, pp. 194-198); "Beginnings of Hindu Pantheism," 1890; "Sanskrit Mutes called Mūrdhanya, that is Domal," in the *Festgabe Kaegi,* Zürich, 1919; and many others.

Such is the work of the scholar to whom, on the occasion of his eightieth birthday, we dedicate the first issue of this JOURNAL, with our respectful greetings and well-wishes for many creative years to come. His many pupils scattered throughout the

world will always remember his kind guidance, for besides being a great and profound scholar, he is a friend to every student, always ready to assist and encourage them in their studies. I reserve the privilege to present elsewhere the inspiring portrayal of this teacher and man.

The above lines are not merely an appreciative tribute by a former pupil; we feel it to be an appropriate moment to recall the work of this great teacher, whose toil in the field of Indology may well serve as an example for the scientific activity of this Institute.

ARCHAEOLOGY AS A SCIENCE

By RALPH V. D. MAGOFFIN

President, Archaeological Institute of America
Head, Department of Classics, New York University

ARCHAEOLOGY did not begin as a science. When Alexander the Great, on his campaign to the east, stopped to visit the supposed site of Troy; when the Roman Emperor Augustus had a number of Egyptian obelisks brought to Rome to decorate the *spinae* of various *stadia;* when consuls and emperors brought to Italy thousands of splendid pieces of eastern and Greek antiquity to decorate temples, fora and villas, it is certain that none of them had a scientific reason back of his acquisitiveness.

The first fifty years of the exploration and excavation of ancient sites, tombs and monuments, has nothing in common with scientific archaeology. It is less than two hundred years ago that political and military campaigns opened up the countries of the Near East so that they might with reasonable security initiate searches for the relics of the past. But despite occasional attempts of scientifically minded officials to control or stop illicit digging, the lure of possible finds of monetary value was too strong to be overcome. The authenticated stories of tomb robberies in Egypt where eager intruders stamped about over "acres of mummies" in order to find what gold or jewels had been left by yet earlier robbers, the wilful destruction both by natives and by foreigners of many monuments, the utter carelessness with which things of non-monetary value were thrown about, prove that the early days of what finally became the era of modern archaeology were nothing less than an unorganized but ubiquitous campaign for loot.

Lord Byron called Lord Elgin a robber only a little more than a century ago, when that British official in Greece took advantage of Greek apathy or helplessness, due to the political situation, and shipped to England those wonderful pieces of pedimental sculptures and frieze reliefs that the world knows as the Elgin marbles of the British Museum. Elgin's interest seems to have been personal. It is certain he did not steal those marbles, and it is clear he did not get them to sell at huge prices for his own profit. But he had no scientific archaeological end in view, although it is now beyond doubt that he did art and archaeology a tremendous service by bringing

marbles that are beyond price and imitation to a place where they are preserved from accidental or purposeful destruction. Other European countries have served science in the same way by bringing to protected places objects of antiquity from small and bickering states of the Near East, no matter whether their object was scientific or not.

It was accidental discoveries of objects of a compulsory scientific character which led on to definitely scientific excavation. Such finds as that in 1506 A. D. of the Laocoön group in the Golden House of Nero at Rome, as that of marbles, bronzes, and papyrus mss. at Herculaneum in 1753, as that of the Rosetta Stone in Egypt in 1799, as that of the rock-hewn Petra in 1812, as that of the mosaic of Alexander the Great in Pompeii in 1831, as that of the Regulini-Galassi tomb at Cervetri in Tuscany in 1836, brought the scholarly and governmental world to a realization that exploration and excavation must be conducted under proper safeguard and with scientific care.

The work of Mariette at the Serapeum at Memphis in Egypt, beginning in 1851, was done with all the scientific care of which archaeologists at that time were capable. When Schliemann made the discoveries which threw the world into its first archaeological excitement, namely, those excavations at Troy, Mycenae, and Tiryns, which began only so short a time ago as 1871, he knew very little of the science of his work. He made many mistakes, he harmed some of the sites, he misinterpreted part of his finds; but his mistakes were the school of science. The French at Delos and at Delphi, and particularly the Germans at Olympia, where in 1875 to 1881 the first correct foundations for the science of archaeological excavation were laid, gave to the world methods and criteria from which there has been little deviation since except along the lines of a wider recognition of the value of artistic and historical background, and of the multiplications of implements and devices that have almost eliminated the possibility of subjective error.

The greatest of the unforgivable sins of a person who finds an object of archaeological character is to move it from its place of discovery until every possible circumstance connected therewith is carefully and exactly noted. Photography is probably the best single help in later identification, but that is not enough. The depth at which an object is found, the stratum in which it is, the position in which it lies, can not be shown certainly by photography; here is where the note-book must be used. All museums have thousands of objects which have great artistic, historical,

epigraphical, and monetary value, but their scientific value is almost non-existent if there is no authentic record of where and how they were first discovered.

The great number of "digs" now under way in different parts of the world show the interest that archaeology has aroused. The increasing number of museums, both those that are public and those that are connected with educational institutions, are witness to that world-wide interest. The laws and regulations under which concessions for excavations are secured, the methods of governmental oversight, the division of the things found, are all framed and conducted in such ways that the demands of science are met. Governments no longer care to meet the criticism that follows unfair or careless exploitation of the sites where scientific archaeology has the first claim.

Let us grant then that there is a widespread interest in archaeology; that archaeology has grown to be a true science; that general culture is greatly widened and enhanced by the objects of beauty and value which are filling hundreds of museums; that governments have responded to the demands of science that exploration and excavation be conducted by competent persons: we may almost go on to say that there now attaches a national disgrace when looting of tombs, illicit digging, or uncontrolled dispersion or sale, is allowed.

Excavations are done nowadays on a somewhat extended scale, and considerable money is needed to finance them. Private persons are not as interested as they once were in such financing, because no longer do the objects found go easily into private museums. Certain governments subsidize archaeological schools, a method which has produced thus far most excellent results. Wealthy benefactors, who do not wish the objects found, and, more particularly, great foundations with money to spend, either through universities or museums, or official scientific organizations, are beginning to divert their attention to archaeology. To avoid any useless expense has naturally come to be a primary object. More sciences than archaeology are profiting from this fact.

One may cite Italy in this connection. Many discoveries of importance have been made in Italian territory, and many pieces of archaeological work are now in progress. But from the great archaeological survey now being completed it is certain that the better sites will be chosen for future work and that both time and money will be saved by having a knowledge first of what has been done, and where, and also of where the likelihood of finding good sites is negligible. National or district preliminary archaeological surveys are now the order of the day.

For a museum or university to secure a concession is, as yet, a matter only for straightforward and reasonable negotiation. Regulations are a matter of record, an abundance of governmental overseers is to be had. Trained personnel for scientific excavation beyond that in the field is, however, now very hard to secure. That means that more workers must be trained.

The first *desideratum,* which amounts almost to a requirement, is that aspirants to scientific archaeology be keen for that work as a profession. Women are as good archaeologists as men, and they can work practically anywhere that men can. Field archaeology is the most exciting side of the profession, but there must be as many trained persons to fill the more important positions in the teaching staffs of the universities, in the personnel of the museums, and in the research and publication field.

First of all, aspiring students must have linguistic and historical equipment. Not all students have natural abilities in mechanics, in drawing and sketching, topographical intuition, in human tact. But students can gain some proficiency along those lines by practice, and they can learn geology and some engineering; they can read on art and archaeology. Preliminary training can be had now in many universities and museums, enough so that a reasonably mature student can go out on a field expedition and be much more than a tyro. But it will be in the field where he will gain the real command of archaeology by working under the direction and oversight of competent excavators, photographers, draughtsmen, epigraphists, ceramists, engineers and architects.

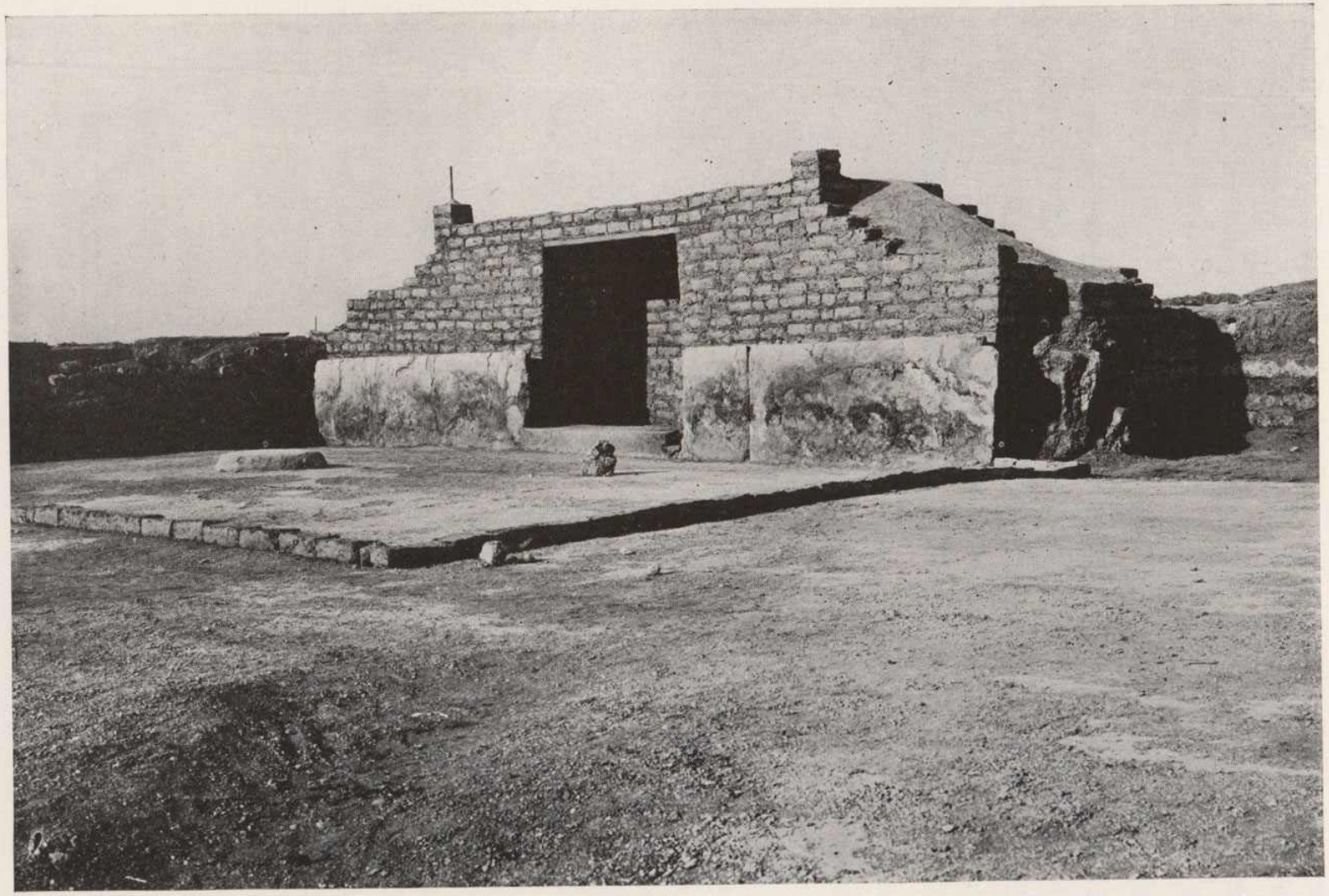
The budding archaeologist must go through serious work in learning scientific method; he must acquaint himself with the variety and use of the scores of things that go to make up an archaeologist's outfit. He must learn to plot and keep up local and itinerary maps; he must become proficient in photography; he must learn what and how to observe, and then how to measure; and particularly must he learn how to keep a note-book record with meticulous accuracy. He will learn how to copy, and how to draw; he must have much practice in how to move objects without breaking them, how to preserve those that are liable to disintegration, how to shore up things on higher levels, how to pack objects that they may be moved without danger of being broken or harmed, and how to mark all objects so that the marks will be unobtrusive and so they will endure.

There are many small printed helps for the archaeological beginner, of which the best is a small handbook printed by the British Museum, entitled *How to Observe*

in Archaeology. Such a book is a pocket *Vade Mecum* of an indispensable sort. Preliminary study, reading, and museum work helps the student to go to the field with considerable personal equipment; field work fits a museum or university expert to be an archaeological authority; both are necessary to fit one for scientific interpretation and consequent publications.

Sir Flinders Petrie recently said:

"The value of archaeology is to discover the histories of other nations, to bring to light the reasons why they became powerful and why they fell. Our work is to provide the world with data to avoid the mistakes of those who have gone before us. We have revealed the fall of the Romans and the causes for that fall, and we present the results of our investigations to the Governments of today. They must act upon them."



THE HOLY OF HOLIES OF THE TEMPLE OF NIN-EGAL, QATNA, WHICH ONCE CONTAINED THE GOLDEN STATUE OF THE GODDESS. THE RESTORATION OF THE UPPER PART OF THE EDIFICE SHOWED THAT THE BRICK WORK AND THE PROCESS OF CONSTRUCTION REMAINED THE SAME AT MISHRIFÉ FOR 4,000 YEARS.

THE ART OF EXCAVATION

By Count du Mesnil du Buisson
Director of Archaeological Excavations at Qatna, Khan-Sheikhoun and Souran, Syria.

"NOTHING is simpler than making excavations, and at the same time, nothing is more difficult. Excavating in order to collect objects without attempting to deduce from them one scientific conclusion is within the reach of all. But excavating with discernment, for the purpose of making the excavated material yield all possible scientific data, is the work of scholarship and experience." Thus did Jacques de Morgan express himself in his counsels to his collaborators. The guiding principle ought to be that reasoning is always true when it is based on exact knowledge and concise facts. On the other hand, errors will always occur when the facts on which one relies are themselves incorrect or inexact. Keen observation is, then, the basis for all methods of excavation. The more complex the problems presented, the more involved the social phenomena, the more important it is to set up criteria, based on comparable facts and free from erroneous conclusions. History has already been partially reconstructed on such principles; it is a question of continuing.

This idea leads us to ask what role excavation should play in historical research, what place its technique should take in the consideration of proper methods for furthering the study of human evolution.

History offers two ways of studying the past; through texts, that is, events as recorded by man, and through archaeology, that is, the evidence of material facts.

Archaeology is the *science of ancient monuments,* monument being taken in its etymological sense of *monumentum*: a memento, a vase, an amulet, a mummy, a stain of blood, even traces of footprints in a tomb are monuments. However fragile these things may be, however elusive, they are still material, they are visible and measurable, and capable of reproduction.

In reality, the study of texts and archaeology are two faces of the same medal. Both have their advantages and their inconveniences; men are more open and more communicative, but they are liable to false conclusions and prejudice; objects, more laconic and more obscure, are yet more credible. The best way, when possible, is to combine the two methods: lacking texts, the prehistoric sciences progress only with the greatest difficulty; and on the other hand, it is because of the neglect of archaeology that history has so long been entangled with legends.

In general, archaeology serves for the verification and explanation of texts, and it would evidently be a grave error to neglect either one of these two sources of infor-

Note: This study was made the subject of a conference by the same author at the Ecole du Louvre, **Cours sur la technique des fouilles archéologiques,** first year. Translated from the French.

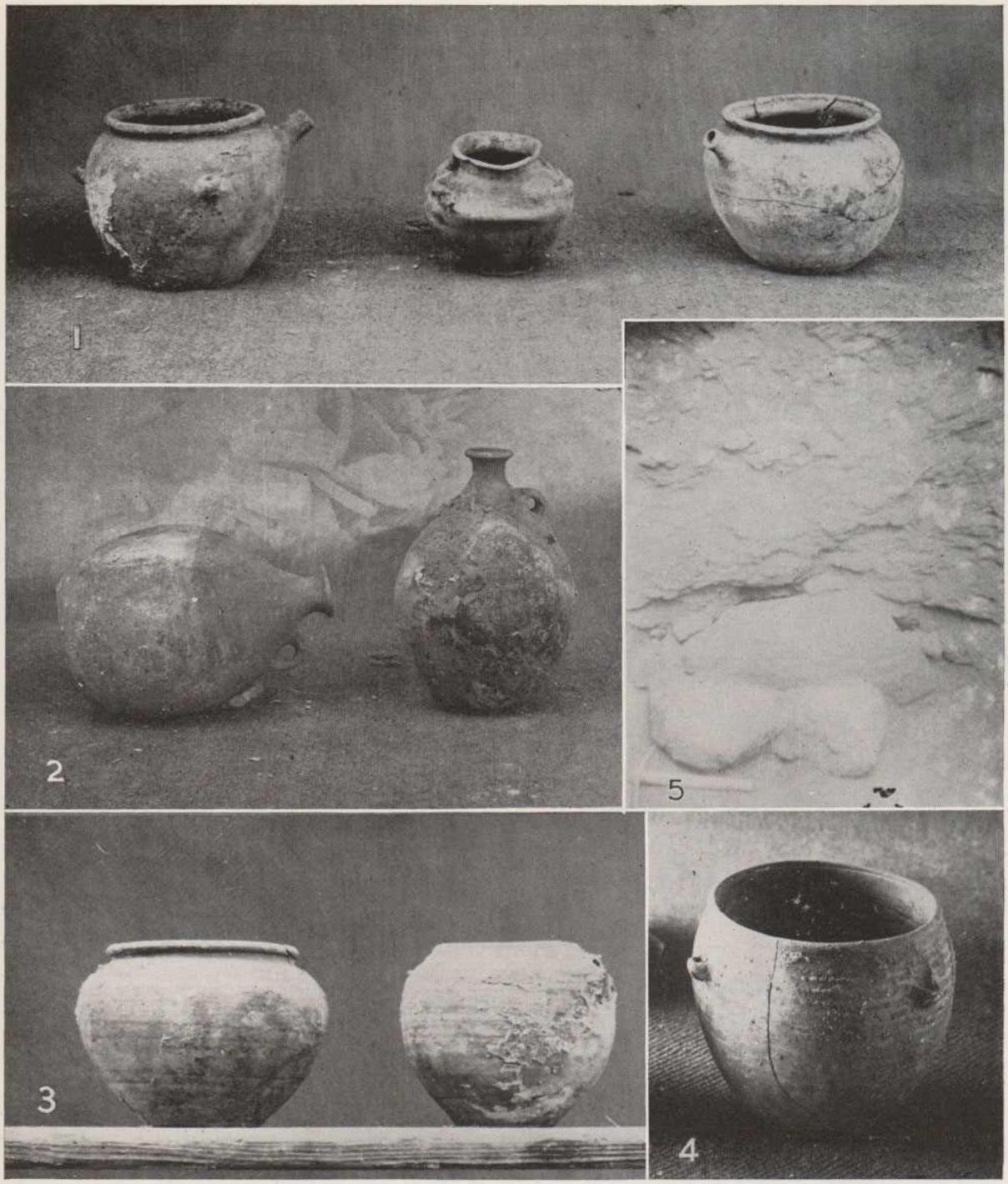
mation. In publishing texts, the excavator serves history; in publishing discoveries of monuments, he serves archaeology and thus history also.

I am greatly indebted for the plan I have followed in this study to *The Introduction to Experimental Medicine*, by Claude Bernard. This is a little book which I would advise everyone to re-read as a breviary for all scientific methods. The technique of medicine, like the technique of excavation, is an *art* intimately connected with the sciences. In medicine these sciences are physiology, pathology, therapeutics; in the technique of excavation they are, as we have just said, history and archaeology. As an art, medicine endeavors to nurse and to heal; equally, as an art, our technique aims to discover the material evidences of historic facts. The great difference is that the study of medicine, as the study of all other natural sciences, constantly makes use of experimentation; that is to say, it is capable of artificially producing phenomena; as for us, we have almost no other recourse but the observing of the material evidence, without being able to reproduce it. Our position is a little like that of the astronomer who is separated by millions of kilometers from the phenomenon of which he can see only the manifestation. Likewise, hundreds and sometimes thousands of years separate us from the event of which we see only the traces.

It should not be thought, however, that archaeology never makes use of experimentation; on the contrary, the following are two examples which show how experimentation may serve the excavator.

During my third expedition to Mishrifé, I had occasion to collect from the 300 vessels around Tomb No. 4, a residue which still adhered to the sides and bottoms. This residue, dating back more than two thousand years before our era, represented food that had been laid beside each of the numerous corpses buried in this vast tomb. M. Guillaumin, Director of the plantations of the Natural History Museum in Paris, was kind enough to undertake the ungrateful task of examining the contents of the hundreds of little bags which contained the residue we had carefully collected. In one of these he discovered particles of a paste analogous to that of bread or cake. The advanced state of decomposition did not permit us to determine the kind of flour used—whether wheat, rye, barley, etc.—nor the leaven, the manner of preparation, mixing and baking. M. Guillaumin conceived the idea of preparing numerous samples of different pastes, variously baked. He then exposed them to decomposition analogous to that in a tomb; that is, he placed them in dark and humid surroundings, thus obtaining from each of these carefully labelled samples, after they had dried, a powder that was easy to analyze chemically and to compare under the microscope with the residue found in the vessels. The experiment did not produce all the hoped-for results; but the method was excellent and worthy of imitation in numerous instances.

Knowledge of the composition of the concrete and mortar used in various epochs would be most useful in making comparisons of edifices. Restoration of monuments is often veritable experimentation, for it requires the solving of many problems and often leads to the discovery of the processes used by the ancients. When Legrain was



SEVERAL TYPES OF VESSELS (FIG. 1-4) FROM TOMB NO. IV, QATNA, IN WHICH WERE FOUND FOOD REMAINS THAT HAD BEEN PLACED NEAR THE DEAD. FIG. 5 SHOWS THE STONE CLOSING THE ENTRANCE TO TOMB NO. IV.

THE DINING ROOM OF THE MISSION DU MESNIL DU BUISSON AT QATNA. A COLLECTION OF VESSELS FROM TOMB NO. IV.

reconstructing the enormous columns of Karnak, did he not show by this *experience* how the ancient Egyptians were able to raise enormous blocks to astounding heights, and that they must have used analogous methods?

It was by means of breaking up pieces of flint and reassembling them that prehistorians were able to give an account of the processes used by ancient man in fashioning arms and implements. The technique of flaking from the core and the later percussion method were certainly developed through some elementary experience. We have here a means of investigation that is not to be neglected, but should be resorted to much more often than has been done so far.

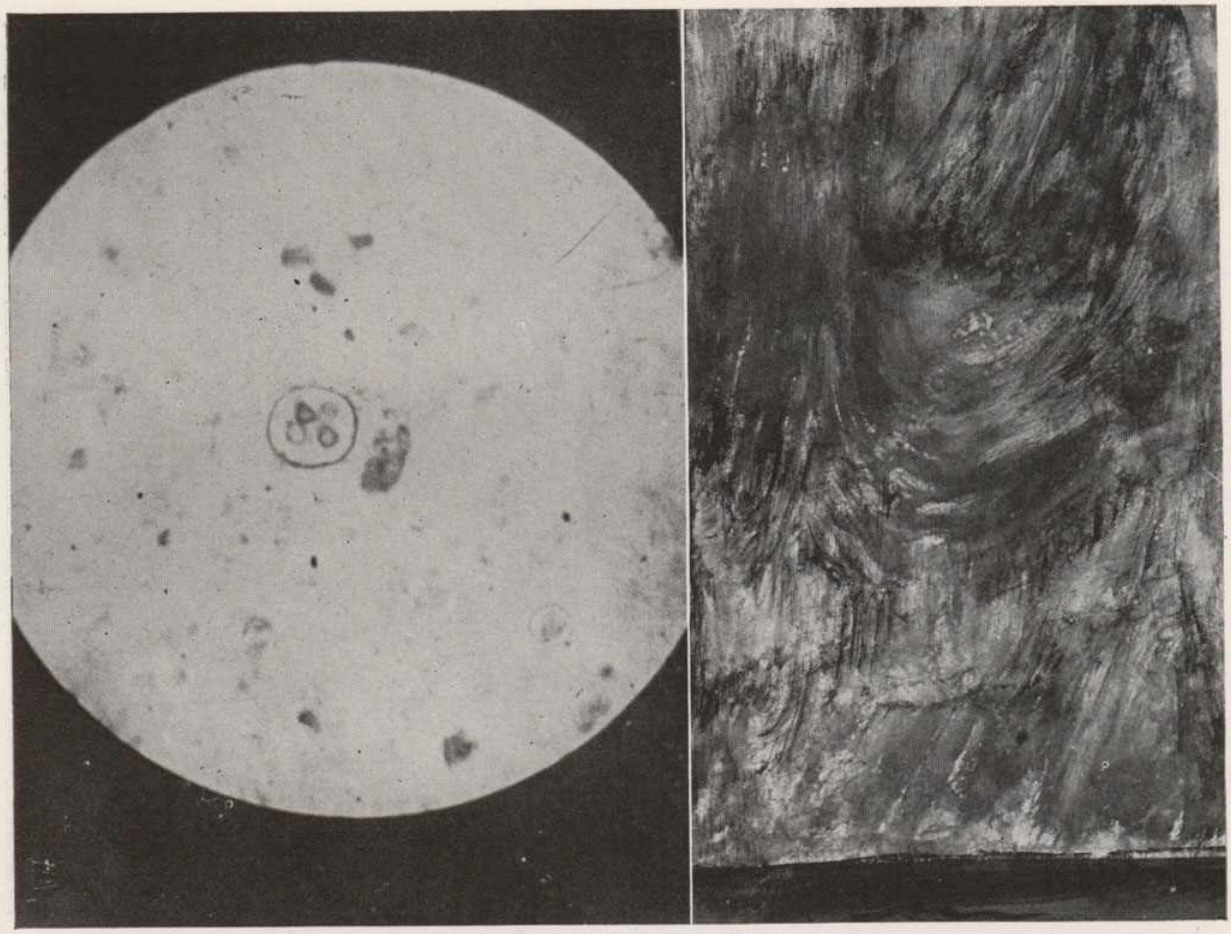
It is no less true that the technique of excavation is above all a science of observation, and that in most cases we have to limit ourselves to establishing a fact and explaining it by comparison with similar facts that are better known to us.

Moreover, excavation is a means in itself of developing our capacities, enabling us to get at remains otherwise inaccessible to us, and any method that helps us to supplement the keenness of our senses will be an extremely useful aid. In our technical studies we have examined the methods which ingenuity has suggested to

ONE OF THE SACRIFICIAL BASINS AT QATNA, WHICH BORE THE TRACES OF BLOOD. IN THE BACKGROUND, TO THE LEFT, IS THE HOLY OF HOLIES OF NIN-EGAL.

man in this regard. These methods are physical or chemical. To the first class belong cross-sections and colorations, examination under the magnifying glass and the microscope, all the methods, more or less perfected, of measuring and computation—spectral analysis, etc. . . . The second are based on the reaction of bodies on each other; this is analysis verified by synthesis, or simply, the study of their chemical properties.

The following are two examples which I again take from the excavations at Qatna. In clearing the southern part of the temple of Nin-Egal, near the southwest corner of the great temple court, we discovered two square plots surrounded by three meters of concrete. Each of these plots terminated toward the east in a round basin of masonry, the brim of which was on a level with the ground. We soon found that a little canal united the basin with the plot itself. After the basins had been carefully cleared, we discovered that several coats of whitewash had been applied similar to that used by the natives of the place even now for the interior and exterior of their houses. Examination under a magnifying glass enabled us to count the successive coats of whitewash, which proved at least that this place had been in service for a long time.



RIGHT, FACSIMILE OF THE STAINS OF BLOOD PRESERVED UNDER THE COATS OF WHITE-WASH IN THE SACRIFICIAL BASINS AT QATNA. LEFT, GLOBULES OF THE BLOOD OF BULLS FOUND IN THE SACRIFICIAL BASINS AT QATNA (MICROGRAPH).

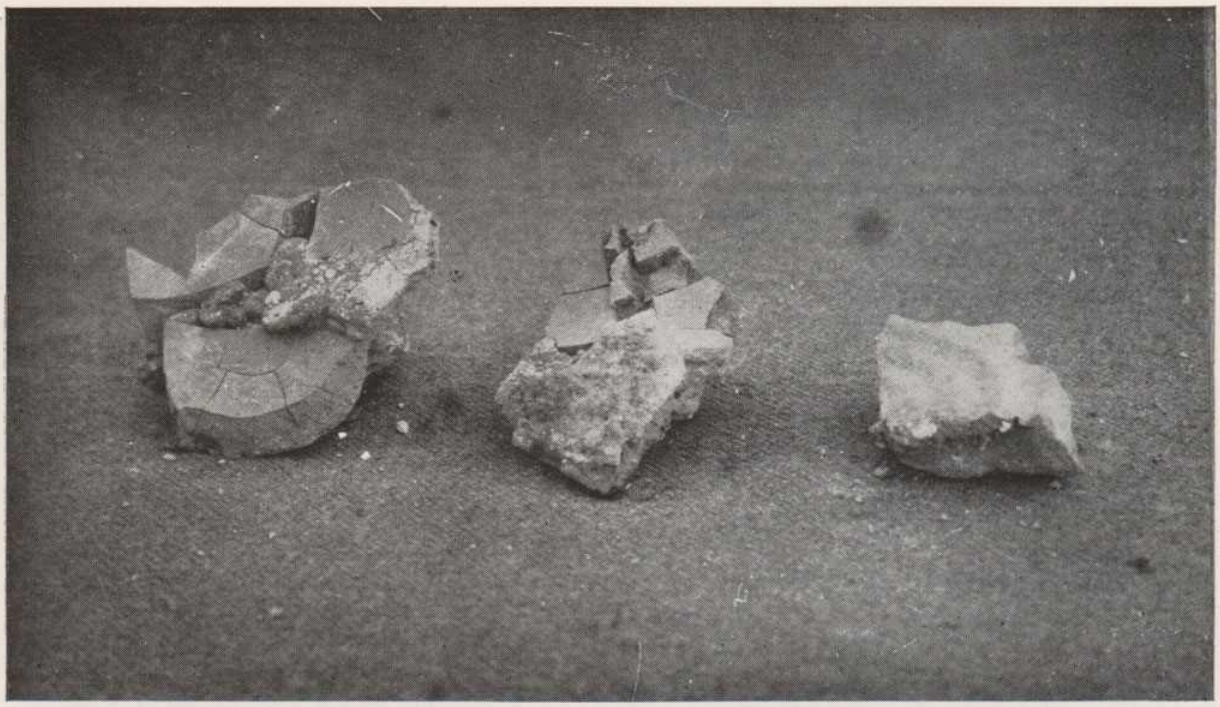
In one of the basins we observed between the coats of whitewash a clear, almost uniform, dark brown stain, which did not have the color of whitewash but might be due to diluted argil; near the bottom there were large brown stains which seemed to have been spread out by rubbing, as with a cloth or brush. We noticed also that the dark brown stain was repeated between the successive layers of whitewash. This was all that we could deduce from direct observation. Samples of the plaster taken from various parts were sent to the French laboratory for examination. As I suspected that the stains were traces of blood, I approached the Prefect of Police, who is experienced in analyzing such stains through his work with criminals. M. Florentin, Assistant Director of the laboratory, succeeded in applying coloring to these globules which, indeed, had existed for the last three thousand years, and was thus able to make them perfectly visible by magnifying them 250 times. He was even able to obtain the micrograph shown herewith. Here, one can plainly distinguish the *hematin* of a mammal that differs from that of a man. Unfortunately, since the blood plasm had been entirely dessicated, it could not be restored, and it is therefore impossible

VIEW OF THE TEMPLE OF NIN-EGAL, AT QATNA, AFTER COMPLETE EXCAVATION.

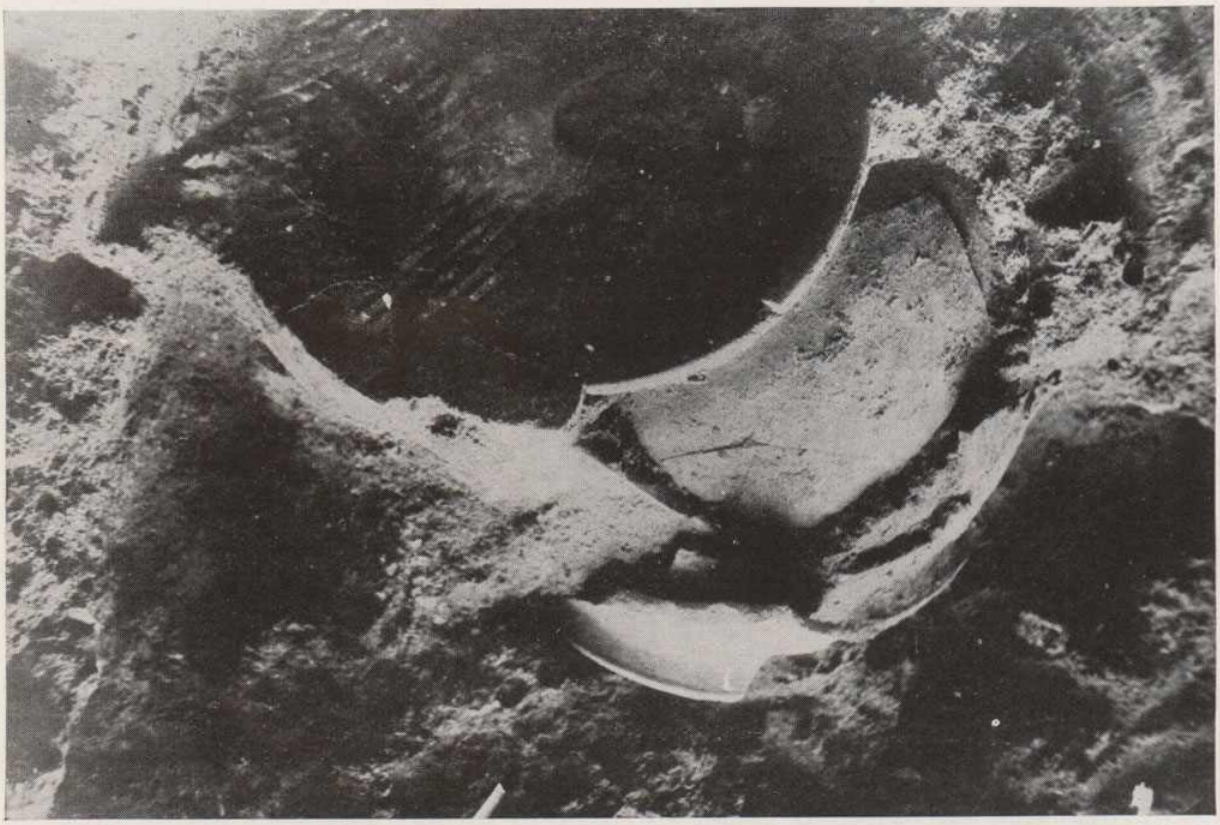
to specify more precisely. However, the information obtained is most valuable, and leads us to believe that we have discovered taurobolic vaults of the greatest antiquity.[1]

The following is an example of chemical investigation. As you perhaps know, the temple of Nin-Egal and the palace form a unit on the rising ground of the church of Mishrifé, comparable to that of the temple and palace of Solomon on the hills of Zion. The state of the remains proved at once that a violent fire had destroyed them; the ashes and the charred beams formed a layer which in spots reached a thickness of one yard. However, one could recognize differences in the composition of the magma. The stones of which it was composed had not undergone the same transformation through the action of the fire. Knowing that limestone burns at about 700°, gold at about 1000°, and basalt at about 1300°, we could create a sort of scale of temperatures. In the case of gold and basalt, their globulous appearance revealed at once that these temperatures had been reached. In order to determine the state of calcination of the limestone I used a solution of hydro-chloric acid, by the advice of

(1) Reports of the Académie des Inscriptions et Belles-Lettres, 1928, page 219.



FRAGMENTS OF A BASIN OF BASALT BURNED AND PARTLY MELTED IN THE FIRE AT THE PALACE OF QATNA.



PART OF THE FOUNDATION STILL IN PLACE UNDER THE TEMPLE OF NIN-EGAL, AT QATNA.

M. Orcel, Assistant in Mineralogy at the Museum. Thus, we could reëstablish the approximate temperatures reached at the time when these parts of the buildings were destroyed.

The greatest heat, that is to say, the melting point of basalt, was observed in the northeastern corner of the Hall of the Grand Vase; the minimum heat was evidenced in the unburned limestone in the outer courts to the north and south. This led us to the conclusion that these extensive esplanades must have been open to the sky, and that the northeastern corner of the Hall of the Grand Vase was approximately the center of the fire, two facts which the successive steps of the excavation seemed to indicate plainly. Moreover, a temperature sufficient to melt basalt can be explained only by a violent current of air, having the effect of bellows in a forge. This hypothesis was definitely confirmed this year by the discovery of a succession of doors creating an intensive draught. With regard to the gold, M. Orcel found this melted into microscopic globules; at times it appeared to be in the form of remains of gold leaf that had covered the cedar wainscoting.

These are only examples, but it is undoubtedly no exaggeration to state that the progress of the experimental sciences and of observation is measured by the perfecting of methods of investigation, and that the greatest scientific truths have their roots in the details of observation, which constitute to a degree the soil in which these truths are developed.

When an excavator has ascertained a fact by observation, his first anxiety is to preserve it, and to write a document which will serve at the same time as a proof of his finding, and a means of further study. To prevent any errors arising through the imperfection of the senses, through imagination or unskillfulness, he uses first and by preference, mechanical and automatic methods, the principle ones being photography, the making of models, casting and topography.

Everyone knows the marvelous assistance rendered by photography — both aerial photography and microphotography; large edifices, such as temples and theatres, circuses, road systems and unknown cities, have been discovered thanks to aerial photography. Topography assists automatically through precise methods of drafting and trigonometrical surveys. The personal quantitative is reduced to the minimum. The photographer, the molder and the topographer merely direct a work, the results of which they cannot affect. Their art — and it is a great art — is to direct it well. Intellectual or graphic methods merely constitute a complement, indispensable, it is true. These methods include description and sketches. However, even these are made as automatic as possible: description, by a definite and unvaried vocabulary and by a logical and unchanged order in the examination of the various characteristics involved, which, whenever possible, should be translated into figures; and in this regard, I will perhaps surprise you by saying that nothing is so difficult as taking exact measurements. Inclinations and cardinal points are always represented by degrees. The

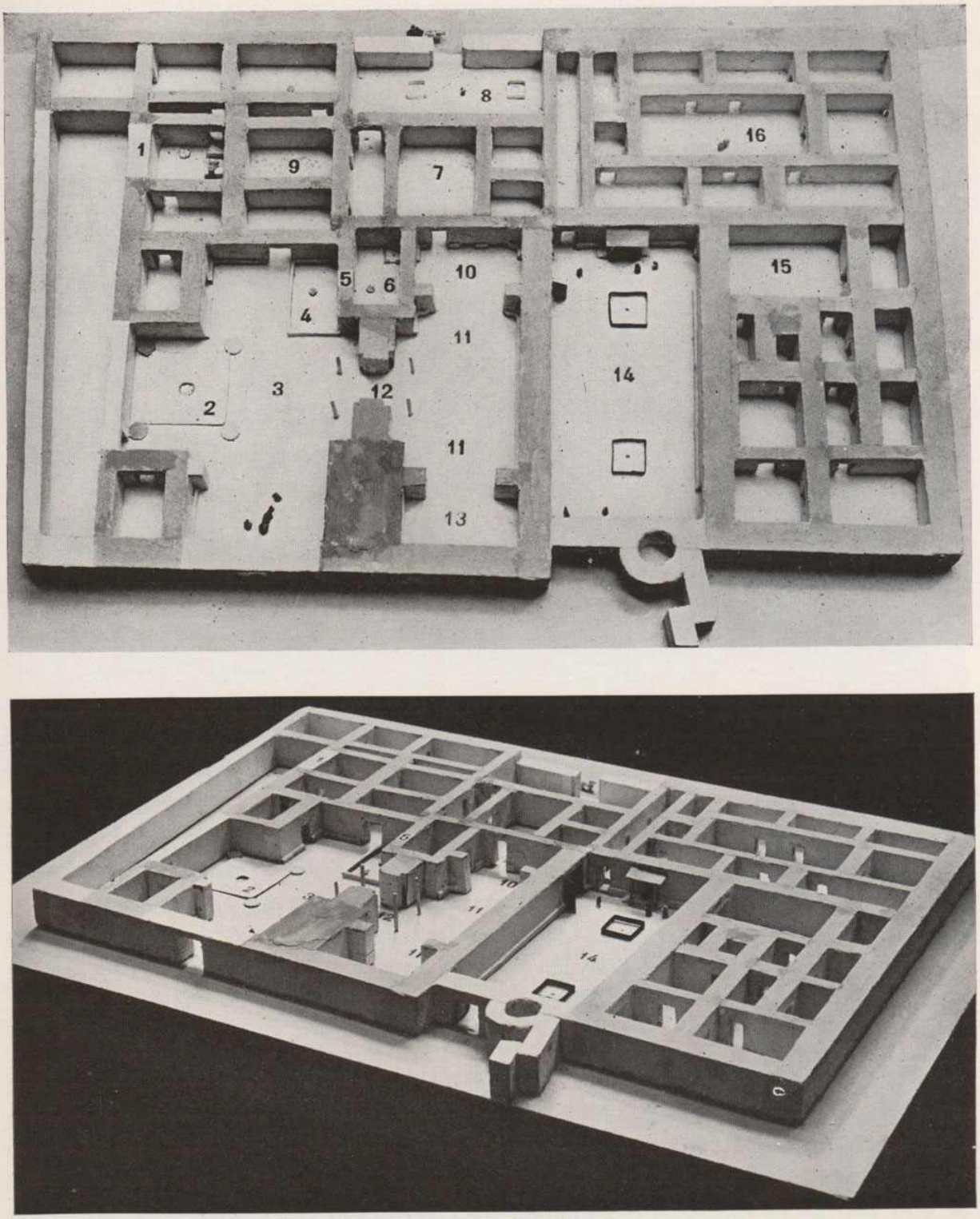
sketch is also rendered almost automatic by the application of a scale of measurements, the indicated walls, the theoretical cross-sections, and by the use of the *camera-lucida*. The sketch thus will duplicate the photograph without replacing it; one would be the intellectual and the other, the mechanical representation. The result of this system is that the publication will consist chiefly of photographs and drafts; with text and sketches alone there is too much risk of giving only the approximate truth.

My exposition would, however, miss its purpose if it would leave the impression that the excavator is a sort of automaton, merely a perfect registrar, that all his thinking, all his ability, all his ingenuity are centered on the one idea — to see more, to see better, and to record what he has seen. Even though this is indeed essentially his task, such a view would be too simple, and erroneous. The reality is far too complex, far too rich in detail, for one to dream of seeing all, much less of retaining and recording all. Moreover, a vague accumulation of facts without a guiding and animating principle would be sterile.

The excavator has, first, to direct the work according to certain observations; second, to choose and discriminate from among the facts presented to him by sites and monuments, the most characteristic and the most significant. In this choice, which governs his whole labor and that of his entire mission, the excavator is guided by reason, induction and deduction, always checking these with the facts.

The guiding principle is his hypothesis. This should comprise all that is already known about the subject, in order to guide the research with greater surety toward the solution of those problems which most interest science, and which would be of the greatest import for the continuation of the work. For example, having come across a building, he concentrates on the details characteristic of its purpose, or on the style indicating its epoch. If he discovers a fragment of an inscription, he will wish to find its original place, to collect the missing parts, and to determine by the indications, the circumstances of its destruction and the dispersion of the fragments.

Thus, the excavator must intellectually fix for himself two goals. When problems are as complex and as difficult to study as those presented by excavations, he will constantly meet with an unforeseen and isolated fact, without any connection whatever, seemingly inexplicable at first sight. His preconceived idea or hypothesis must then give way to observation, and the fact must be studied with the same care as if it had been foreseen, as if it fitted in the original plan of procedure. It is a fact that "rests in the air," waiting for an explanation. The excavator must resist the temptation to neglect what he does not understand. In the second place, the hypothesis should remain tentative until facts confirm or nullify it. It is a simple method of forcing the monuments and sites to yield their secrets, a method of asking questions; and it is necessary to be silent from the moment the monuments speak, to listen to their answers — to listen to the very end, and in all cases to submit to their decisions.



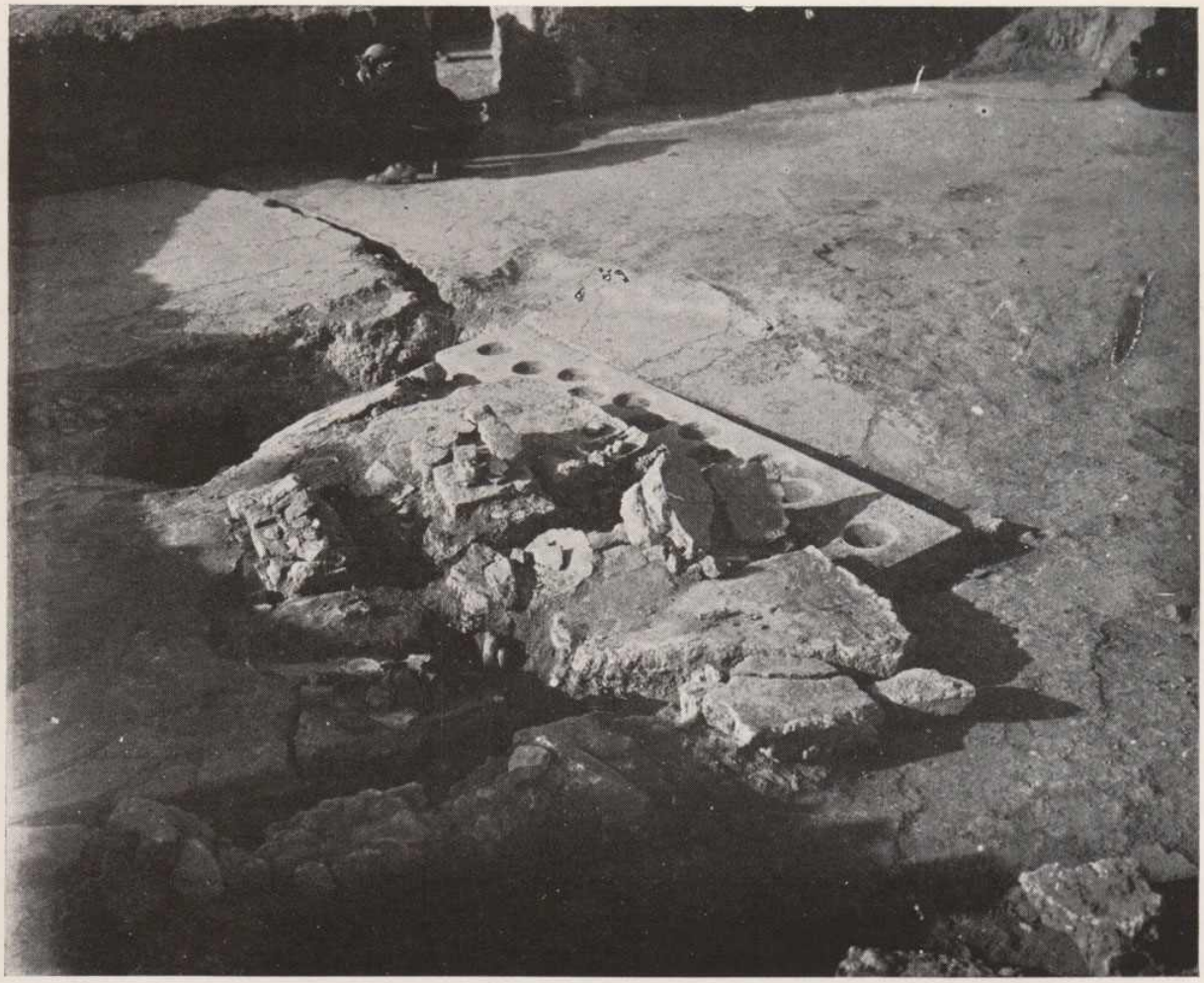
TWO VIEWS OF THE RESTORED GROUND-PLAN OF THE TEMPLES AND PALACE OF QATNA (BETWEEN 2000 AND 1375 B. C.): 2, THE TEMPLE OF NIN-EGAL; 11, THE GREAT ANTE-CHAMBER OF THE PALACE; 14, THE THRONE-ROOM.

One must never reply for them, nor take only those facts for true which favor or confirm the hypothesis. There is here a question of professional honesty and intellectual discipline.

There are excavators who after a hurried examination, are guided by some preconceived idea which seems to them logical and reasonable, and endeavor to verify this idea by their observations. This is what a great historian and philosopher, Fustel de Coulanges, has to say of such procedure: "Instead of studying the object itself for what it is, you bring to it your personal conclusions. You think that you are studying the object, but you are looking only at your own concept of it, and you are dominated by this concept to the extent of seeing nothing but this, and of seeing it everywhere. *This is the greatest source of error in history.* There are minds which for this very reason are incapable of ever seeing the truth."

One can summarize the following relative positions of observation and hypothesis. While conducting his searches, the excavator gives free course to his reason and creative imagination. As soon as he has made a find, he concentrates all his attention on the exterior evidences, to grasp them to the least detail, and to record them in their entirety, with complete self-effacement. When he is in possession of definite facts that have been carefully recorded, he again has the right to construct by hypothesis a provisory system for verifying the facts by comparison. He instantaneously has to change from the active attitude of the investigator to the passive attitude of the observer, and then to return to the former, in order to introduce into his experimental reasoning the newly discovered facts. In the course of an excavation, the role of investigator and observer often overlap. An effort to separate them, however, is useful and profitable. It is necessary to tell oneself from time to time, for instance when one removes a stone that closes the entrance to a tomb: "At this moment, I must forget all my theories, all my hypotheses, and make myself a recorder of facts; it is a question of seeing well, of seeing all, but not of constructing." It has sometimes been said that ignorance is the best background for making discoveries. This would suggest that it is better to record on fresh, though unprepared wax, than on material that is finer, but deeply grooved. I repeat, the most fatal error for an excavator is to have *fixed ideas,* clinging to theories for which he but seeks the confirmation.

Here is an example of a successful hypothesis that was well-considered, and that led to a chain of closely connected observations. M. Flinders Petrie noticed in the course of his excavations, that certain measurements in temples or palaces repeated themselves exactly, and that others existed as various multiples of these, or, if you wish, it may be said that certain lengths were divisible by the same number. He asked himself whether he had here merely coincidence, or the result of some unknown principle. He realized that if a fixed unit had served as a standard for the architects and mechanics of the edifices, it must without doubt have been based on the most frequently occurring



HIGH PLACE OR CHAPEL OF THE GODS OF THE KING OF QATNA, WITH CUP-CHISELLED ALTAR. THE PLACE OF THE GODS IS IN THE FORE-GROUND. IN THE HOLE AT THE LEFT, THE BASE OF THE SACRED STAFF REPRESENTING THE GODDESS ASHERA IS STILL IN PLACE. ABOUT 2000 B. C.

measurements, as for instance, the cubits indicated by Ezekiel in the measurements of the temple of Jerusalem. M. Flinders Petrie then made numerous measurements, at about 1 m/m, on all the monuments he had discovered as well as on a great number of other edifices, and established that by perfecting the method a little, one could indeed determine the local standards or units of measurement, through divisions of the various lengths recorded. I must add that this important statement, outlined in detail by M. Flinders Petrie in his book *Instructive Metrology,* has led the author to most extraordinary comparisons. For example, two measurements were found to be exactly the same in the Orient and in Central America. Of course, it is most important to be extremely careful in drawing conclusions from a fact that may have no other reason than the identity of the measurements of the body, which is the universal standard. But after all, the method is interesting and instructive.

In order to better group these various ideas or fundamental principles of the art of excavation, permit me to synthesize this study in a simple table, which may be useful to all those who, as ourselves, seek to draw truth, not "out of a well," but out of the trenches of excavation.

Successive operations	Intellectual dispositions	Knowledge
To discover and To see	No preconceived ideas Tenacity	Technique of excavation and the methods of observation. Technique of the arts and the professions.
To record	Ingenuity	Photography, molding, drafting, topography, etc.; style
Hypotheses and demonstrations	Creative imagination and experimentation	History, archaeology, folklore; natural sciences

PROBLEMS OF TIBETAN ARCHAEOLOGY

By GEORGES DE ROERICH

TIBET remains a *terra incognita* for archaeologists. For decades the study of Tibetan antiquities has been the apanage of scholars who have devoted themselves to the study of Northern Buddhism. Their work consisted mostly of translation from the Tibetan, and the interpretation and reconstruction of lost Sanskrit originals with the help of the extant Tibetan translations. The rich archaeological remains of the country were left unexplored. Up to the present time, archaeological explorations have been unknown in the country of the lamas, which continues to keep its secret from the inquisitive scholar and explorer. Tibet—a country which succeeded in remaining isolated through the Middle Ages and even through modern times—is a unique store-house of antiquity and folk-lore. A thorough study and scientific survey of its town monasteries, memorial monuments or *stūpas*, and numerous and totally unexplored remains of the pre-Buddhistic period, would doubtlessly reveal an unexpected wealth of scientific data with which to reconstruct the colorful past of this unique country. Such an exploration of Tibet is bound to bring new light to the other branches of Oriental studies, such as Indology, Sinology and Central Asian philology and archaeology. A brilliant line of Western explorers has contributed to the opening of this treasure-trove of Inmost Asia. The central position occupied by Tibet and its highly mountainous character have made the country a kind of *reliquaire* of ancient Indian, Chinese and Central Asian traditions.

Northern Buddhism, strongly influenced by the Tantric schools of Medieval India, is known only from Tibetan sources, for the ancient Sanskrit canon has been almost entirely lost in India, and is preserved only in fragments in the sands of Central Asia. Ancient usages, forms of artistic expression long extinct in India proper, are still current in Tibet, and such is the influence and rigid force of its artistic tradition, that a bronze figure of the XIIIth or XIVth century A. D. can hardly be distinguished from an image belonging to the XVIIth or XVIIIth century.[1] This rigidity of tradition is in many instances more stable and immune to change than the written laws of the country.

Central Asia, with its wealth of cosmopolitan influences and the large-scale pictorial compositions of its cave temples, has left an indelible imprint on the art of fresco painting in Tibetan monasteries. A Tibetan temple fresco still recalls the masterpieces of Ajaṇṭā, though this art did not reach Tibet direct across the snow-barriers

1) This does not refer to the bronze images of Eastern Tibet or Khams, where we find a new efflorescence of art (sculpture and painting) in the XVIIIth century, with a strong Chinese influence. This XVIIIth century art is commonly designated by the name of Sino-Tibetan art.

of the Himālayas, but came into the country through ancient Gandhāra, Bactria, and the great countries of Central Asia.[2]

The wealth of historical information on Tibet contained in the *Chinese Historical Annals,* should be studied together with Tibetan epigraphical and other antiquarian remains. In other words, Tibetan archaeology should be the basis of every scientific work on the medieval history of Tibet. The same applies to Mongolia, for the understanding of whose history a clear picture of the part played by Tibet is altogether essential. Written records are not sufficient to reconstruct the past of a country, and it is our firm belief that it is archaeology that will inaugurate a new era in Oriental and especially Tibetan research. By saying this I do not intend to belittle the importance of written records, but only wish to stress the value of corroborative material.

Archaeological investigations were for a long time absent from the field of Tibetan studies. European and American explorers, who braved the dangers presented by the forbidding character of the country and the animosity of its inhabitants, have paid more attention to geographical exploration, to the fauna and flora of the country, and the ethnology of its present inhabitants. This was the natural result of prevailing conditions, archaeological and historical investigations requiring more time and often a prolonged sojourn in the country, a concession which was usually refused to former explorers of Tibet. Most of these explorers achieved striking success in determining the physical structure of the country, and brought back rich collections of its fauna and flora, but were hardly qualified to explore the archaeological monuments of the country. The accounts of their travels give scant information about the antiquarian remains to be found scattered throughout Tibet. Let us hope that a more progressive age will make it possible for scholars to explore archaeologically this most fascinating country.

Whereas the provinces of Central and Eastern Tibet have long been closed to European scholars, the provinces of Indian Tibet, that is Ladāk, Zangskar, Baltistān, Skardo, Lahul, Spiti, Rupshu, and the different Himālayan border states with a Tibetan population, remained open to Western research. The first book on the archaeology of a Tibetan province was written on Ladāk by General Sir Alexander Cunningham (London, 1854). It was a valuable work for its time, but has been subsequently supplemented by the researches of the Moravian missionary, Dr. K. Marx, and especially by the late Dr. A. H. Francke. Much good work was done by E. von Schlagintweit, whose works contain valuable archaeological data. The first savant to go beyond the mere mentioning of the existence of antiquarian remains, however, was

2) I believe that the Tibetan fresco art has experienced a strong Central Asian influence since the end of the Xth century, and the downfall of Buddhism in Central Asia. Tibetan sculpture of the Xth and XIth centuries seems to have developed under the influence of the pāla art of Magadha. (Cf. Hackin: **Indian Art in Tibet and Central Asia. Influence of Indian Art,** India Society, 1925, p. 130).

Amdo, one of the northeastern provinces of Tibet has always been under the strong influence of Central Asian art. It is to Amdo that the Uighur Buddhist monks, and the remaining Hsi-hsia Tanguts fled after the sacking of their kingdom by Chingiz-khan in 1227 A. D. Amdo is one of the most artistic provinces of modern Tibet.

the late Dr. A. H. Francke, the learned historian of Western Tibet and editor of Tibetan manuscript-fragments brought back from Turfan and preserved in Berlin. In his many books and articles dedicated to the kingdoms of Western Tibet, we find numerous allusions and descriptions of both pre-Buddhistic and Buddhist remains, which thus far had escaped the attention of the learned world.[3]

Shortly before the memorable date of 1914, Dr. A. H. Francke conducted on behalf of the *Archaeological Survey of India* an antiquarian survey of Indian Tibet, that is, the Tibetan-speaking countries of the Himālayan borderland, situated within the frontiers of the British Empire. His survey covered the Sutlej Valley with the hill-state of Rāmpur Bashahr, Spiti, Rupshu and Ladāk. The results of his journey were embodied in two volumes, published by the *Archaeological Survey of India,* and entitled "Antiquities of Indian Tibet." [4] The first volume contains the archaeological information gathered during his journey, and Volume II, edited by Dr. F. W. Thomas, the Tibetan text and English translation of the historical chronicles of Ladāk.[5]

Dr. A. H. Francke's volume is the first attempt of its kind to record all the available data about monasteries, both ruined and preserved, *stūpas,* stone sculptures, epigraphical monuments, and other pre-Buddhistic remains, thus preparing the ground for a thorough archaeological study of the region.

There is a sad lack of monographic studies of the great town monasteries of Tibet, which form such a characteristic landmark of the country, and which for centuries have been seats of its political and spiritual life. Some twenty years ago the noted German explorer, Dr. W. Filchner, gave us a description of the great monastery of Kumbum (sKu-'bum byams-pa gliṅ), in Northeastern Tibet,[6] founded in 1583 A. D., although a temple had already been built there in 1577 A. D.

Dr. Filchner's book does not pretend to be an exhaustive monograph on the great monastery, and merely gives a modern picture of it; the rich monastery chronicles were left unexplored. For a long time this book remained the only representative of this kind of literature.[7] In 1929, Mr. H. Lee Shuttleworth, M.A., published in "Memoirs" (*Archaeological Survey of India*, No. 39, Calcutta, 1929) a brief account of the famous Lha-luṅ Temple in Spiti, which dates back to the time of Rin-chen bzaṅ-po (956-1054 A. D.). The temple represents an interesting example of the XIth century art and is rich in ancient wood-carvings and sculpture, as well as inscriptions recording restorations of the temple undertaken at various times by West Tibetan kings. These XIth century temples, of which many are known to exist in Western Tibet, should be studied with the greatest attention, for in them we possess

3) A. H. Francke: "Kleine archäologische Erträge einer Missionsreise nach Zangskar," ZDMG, 1906; "Archaeological Notes on Balumkhar," **Indian Antiquary,** 1905, and numerous other articles in the same periodical on West Tibetan rock inscriptions.

4) **Archaeological Survey of India,** New Imperial Series, Vol. XXXVIII, Part I, Calcutta, 1914.

5) **Archaeological Survey of India,** New Imperial Series, Vol. I, Part II, Calcutta, 1926.

6) Filchner: **Das Kloster Kumbum in Tibet,** Berlin, 1906.

7) The large town monasteries of Northeastern Tibet, Kumbum and Labrang, are known to us from the works of the Russian explorers Tsybikov and Baradyin.

the material evidences of a period whose importance in the whole history of Buddhism in Tibet can hardly be overestimated. Most of these temples were erected with the help of Kashmiri artisans, and their sculptures and wall frescoes represent a precious record of Buddhist art in Northwestern India during the Xth and XIth centuries. Such monographic studies with detailed accounts of all the artistic treasures found in the monasteries and followed by a careful study of their written records and inscriptions, would, doubtlessly, substantiate the information given by ancient Tibetan records. Only archaeology can help us reconstruct the frame-work of the Tibetan past.

In the present article I intend to outline some of the immediate needs of Tibetan archaeology, as well as to enumerate the different fields open to research. Tibetan culture can be roughly classified as that of the valley, and that of the upland. The geographical environment has created these two distinct forms of Tibetan culture, and this division is marked throughout the history of the country. The present culture of Tibet is a composite phenomenon in which the nomads of the upland are culturally blended with the dwellers of the large monastic establishments and agricultural settlements in the valleys. What has been done for the districts of Western Tibet, remains to be accomplished in the provinces of Central and Eastern Tibet. Tibetan archaeological monuments can be roughly classified into two groups, each containing subsidiary members:

I. Archaeology of the pre-Buddhistic period—that is, the period preceding the introduction of Buddhism—and the first centuries of the Buddhist period, during which large tracts of the country were hardly influenced by the new doctrine, and continued to follow the precepts of their shamanistic faith or Bön. To this class of antiquarian remains belong all the megalithic monuments, stone graves, rock drawings, the ancient Bön-po altars or *lha-tho*, and similar monuments. All Bön-po monuments of a later origin mark a period of transition between the pre-Buddhistic and the Buddhist period, but for convenience can be classified with the first group of archaeological monuments.

II. Archaeology of the Buddhist period, that is, from the VIIth century A. D. onward. This class is represented by numerous monuments, such as monasteries, temples or *lha-k̲haṅ, stūpas, māṇi*-walls, stone-pillars and other epigraphical monuments, the sepultures of ancient Tibetan kings in the Yalung Valley, and state and private palaces.

For convenience we shall examine each group of monuments separately:

I. *Archaeology of the Pre-Buddhistic Period*

A vast and well-nigh virgin field is open to scientific research. Monuments of the pre-Buddhistic period are found throughout the country, but are particularly frequent along the border and on the upland. Nomad districts are especially rich in pre-Buddhistic remains (Nag-tshaṅ, Nam-ru, Nag-chu-ka, Hor-sde or Nub-hor, and

the whole of the Grass Country of Northeastern Tibet). Megalithic monuments were discovered by the Roerich Central Asiatic Expedition in the region of the Great Lakes, north of the Trans-Himālayan Range. This class of monuments is represented by single menhirs, groups of three menhirs (these groups should be evidently taken as a separate class of Tibetan megaliths), cromlechs, and alinements.[8] Tibetan megalithic monuments ought to be studied and surveyed. Many of these pre-Buddhistic sites are now declared to be Lamaist sanctuaries; the menhirs are said to be the abodes of the different divinities of the Lamaist pantheon.

Stone graves belonging to the period preceding the VIIth century A. D. are found in groups in the province of Hor-sde, and in Nag-tshaṅ. No doubt they can be found in other districts of Northern Tibet. The Moravian missionaries have discovered interesting graves in the neighborhood of Leh in Ladāk.[9] The finds consist of bronze and iron plaques, also bronze and iron arrow heads. The art of these nomad tribes was rich in "animal" motifs, and has a close affinity to the great nomad art of Central Asia.

An interesting problem is presented by the so-called *zi* beads which are frequently found in cultivated fields, and possibly originate from ancient graves which were accidentally unearthed during the ploughing of the fields. Modern Tibetans pay high prices for such beads, and a *zi* bead with seven "eyes" fetches a very high price on a Tibetan market. The bead is made of agate, and the technique of making it has been lost; in fact, modern Tibetans consider these beads to be a play of nature.

Bön-po sanctuaries are frequently found in the Western Hor region or Nub-hor, Northeastern Tibet, Western Tibet, and in the neighborhood of old Bön-po communities, such as the communities in Southern Tibet, south of the Tsang-po and along the Nepalese border.

Rock drawings have so far been discovered only in Western Tibet (Ladāk, Zang-skar, Lahul), but, no doubt, exist also in other parts of the country. I have seen similar rock drawings north of the Sanju Pass, a few miles outside of Tam-karaul, situated south of Sanju-bāzār.[10] A good many of these rock drawings belong to the Buddhist period, especially those representing current Buddhist symbols, such as *stūpas,* and are accompanied by inscriptions. There can be no doubt that many of these rock drawings belong to the pre-Buddhistic period, and as Dr. A. H. Francke has shown, have a close connection with the Kesar Saga. We may add that some of them, representing in most cases hunting scenes and figures of the ibex, must have been related to the ancient shamanistic fire-worship of the Turkish-Mongolian tribes, and may belong to the same period as those of Southern Siberia, Mongolia and Rus-

8) For a description of the Tibetan megalithic monuments see G. de Roerich: **Trails to Inmost Asia,** Yale University Press 1931; G. de Roerich: **Animal Style Among the Nomad Tribes of Tibet,** Skythika III, Seminarium Kondakovianum, Prague, 1931.

9) Francke: **Antiquities of Indian Tibet,** Vol. I, pp. 71 ff.

10) For West Tibetan rock drawings see Dr. A. H. Francke: **Tibetische Hochzeitslieder,** 1923, pp. 70-71; Pl. I, II, III, Pl: I, 2, 3; Pl. VII, 8; Pl. VIII, 10; Pl. IX, 11; Pl. X, 12.

sian Turkestān. Doubtless many of the rock drawings representing the ibex are wayside offerings made by travellers in more recent times, this being another example of an ancient cult preserved to our day by the rigidity of tradition in Central Asia. Similar rock drawings abound in the Zarafshan Valley and other districts of Russian Turkestān.

A comparative study of the different motifs in the rock drawings discovered in Russian Turkestān, Southern Siberia, Mongolia and Tibet, would, we believe, reveal many interesting facts about this popular form of primitive worship in Central Asia. I am convinced that the fire cult of the Western Turks, described by the famous Chinese pilgrim, Hsüan-tsang,[11] represented this primitive form of shamanistic worship, and had nothing to do with Iranian influences, to which it is generally ascribed.

A separate group is formed by the so-called cave-dwellings, which are still used by the inhabitants of some districts of West Tibet and the southern Tsang Province. These cave-dwellings generally serve as living-quarters and store-houses for the winter. This is evidently a very ancient form of dwelling in Tibet, and should be studied. During my sojourn in Tibet, I found several old groups of these cave-dwellings in absolutely deserted districts, many miles away from any settlement or village. The primitive Bön-po worshippers used caves for their necromantic rites, and an exploration of these abandoned cave-dwellings may yield interesting results.

Bön-po monasteries, frequently found in Northeastern Tibet, the Hor region and Southwestern Tibet, properly belong to a separate group of monuments and mark a transition between the pre-Buddhistic and the Buddhistic periods. Many of them were built in Buddhist times, and evince a strong influence of Lamaist iconography.

II. *Archaeology of the Buddhist Period*

The numerous monuments of this group fall into several well-defined classes. The first includes the large town monasteries belonging to the later period of Buddhism in Tibet, such as Dre-pung (dPal-ldan 'Bras dpuṅ, founded in 1416 A. D.), Sera (Ser-ra Theg-čhen gliṅ, founded in 1419 A. D.), Ganden ('Brog-ri dGa-ldan rnam-par rgyal-ba'i gliṅ, founded in 1409 A. D.), and the other five *ling* of Lhasa; Tashi-lhun-po (bKra-çis lhun-po, founded in 1447 A. D.); Kumbum; Derge; Gön-čhen (sDe-sge dGön-čhen); Labrang (La-braṅ bkra-çis-dkyil, founded in 1709 A. D.); Sam-ye (bSam-yas, founded in 811 A. D., according to Sanang Setsen; another tradition mentions the date of 798 A. D.; the *rGyal-rabs* of the 5th Dalai Lama has the date of 766 A. D. The monastery used to possess one of the richest libraries with a large collection of Sanskrit manuscripts; the library was destroyed by fire and never reconstructed); Tho-ling (mTho-gliṅ, founded about 1025 A. D.), and a number of larger monasteries in Ladāk, mentioned by Dr. A. H. Francke in his *Antiquities of Indian Tibet*, Volume I.

These monasteries own rich collections of paintings, both mural and on silk

11) Beal: **Life of Hsüan-tsang,** London, p. 43; Watters: **On Yuan-Chwang's Travels,** London, 1904, p. 81.

(*thaṅ-ka*); images embroidered in silk; bronze, wood, and clay images of different divinities; and well-furnished libraries of manuscripts and block-prints. Among the manuscripts are sometimes found Sanskrit manuscripts of the Xth-XIth centuries A. D. Often these libraries possess the original edicts of the Grand Lamas of Lhasa and Shigatse, which are extremely important and furnish dates and authentic data on the respective monasteries and regions. The temple records of these monasteries should be carefully studied, and whenever possible a photographic record of all the available artistic treasures obtained.

The second class is formed by smaller monasteries and temples or *lha-khaṅ*. It is precisely in this group that we find some of the most interesting monuments of the Xth-XIth centuries. The Tsang Province, and especially the valley of the Nyang-chu, is rich in such monasteries and temples, and a careful study of them would reveal an extraordinary wealth of material. Some of these smaller monasteries, and even the lonely *lha-khaṅ* or temples, contain rare libraries of early block-prints and interesting frescoes, some of which are dated and bear inscriptions of donations. Such temples are found all over Southern Tibet and are frequent along the western borderland of the country (the temples attributed to Rin-chen bzaṅ-po's time in Ladāk, Lahul, Spiti and the Sutlej Valley). Very often a forlorn village will possess a remarkable temple or village shrine, full of interesting remains. Some of these villages have been important places in the past, and their temples are the only survivals of this period. An interesting group is formed by the cave temples, which are less frequent, but still numerous enough, along the Nepalese border. In most cases these represent hermitage chapels which were often abandoned after the passing away of the anchoret.

The next important group is that of the *stūpas*, *māṇi*-walls and other memorial monuments. *Stūpas* of the early Buddhist period (end of the VIIth to XIIth centuries A. D.) often contain valuable objects of art and manuscripts. Many of the river valleys of Southern Tibet, such as the Tsang-po, the Nyang-chu and the Yalung Valley with its sepultures of ancient Tibetan kings, are rich in antiquarian remains of the early Buddhist period. Many of these *stūpas* are objects of worship and as such cannot be excavated, but the Government and some of the monasteries possess good and detailed inventories of all objects and manuscripts deposited in the *stūpas*. These lists or *dkar-čhag* form a numerous and important class in Tibetan literature, and contain descriptions of Tibetan places of pilgrimage, monasteries, temples, *stūpas* and large temple images, as well as of the contents of *stūpas* and other memorial monuments. The Sino-Tibetan wars of the last two decades have thrown quantities of such consecrated objects on the Chinese, Indian and European markets. *Māṇi*-walls are interesting for the inscriptions of donations which are often placed on them, and which frequently mention historical events.

Tibet is rich in epigraphical monuments. Besides the pillar inscriptions, such

as the famous pillar inscriptions of the Sino-Tibetan treaty of 822 A. D., which represents one of the earliest written records of Tibet, we know of a number of other inscriptions commemorating important historical events, installations of re-incarnate lamas, inscriptions recording the restoration of temples and alluding to historical events of importance, and numerous votive inscriptions left by rich donors and devotees. A *Corpus Inscriptionum* is greatly needed to embody all this vast working material, so invaluable to the historian. These inscriptions are generally found in monasteries and temples which were the centers of the political and religious life of the nation. Some inscriptions are even found on the road-side, carved on rocks and commemorating the deeds of some ancient king. Private palaces of the old Tibetan aristocracy, many of whom trace their families back to the ancient kings and tribal chiefs of Tibet, are real museums of old art objects. They often possess good private libraries of manuscripts of Tibetan religious texts, written in the old orthography. The study of these collections will considerably enrich our knowledge of Tibetan art.

When all this mass of material will have been properly analyzed and commented upon, we may hope to assemble the information scattered throughout the voluminous literature of Tibet. We are still very far from the day when detailed archaeological explorations will be possible in Tibet. Tibet has not broken away from its past, and jealously preserves its ancient records. Perhaps the day when archaeological investigations will be possible, will never come, but, on the other hand, every year brings in new material and new facts about the archaeological monuments of the Hidden Country, and we may hope for a better future in Tibetan studies. All this mass of material should be carefully collated with the written records of the country, and thus a firm ground prepared for further studies in the domains of Tibetan secular and ecclesiastic history.

TECHNIQUE OF BODY AND MIND

(Principles of Self-Development)

Lecture Delivered at University of Toronto

By C. C. LOZINA, M. D.

FROM ancient times to our days men have been striving to develop their bodies and minds by means of different exercises. There existed and exist now various schools of physical and psychic education, which aim to bring health, success and spiritual perfection to individuals. Most of our Western schools are interested exclusively in developing the physical strength of man and creating for him hygienic conditions of life. For this purpose they adhere to various physical exercises and sports, aiming to develop the muscles, but forget the importance of developing the nervous apparatus and psychic power. Indeed, body and mind are so intimately cooperative and so mutually conditioned, that it is really surprising that the necessity for their parallel development is not yet fully appreciated. Even the schools which understand this need in most cases do not have a scientific foundation. Their physical and mental exercises have no common principles and are not sufficiently condensed or balanced.

The present infatuation with sport and physical culture has assumed an ugly and unhealthy shape. From my experience as a medical adviser at one of the leading Canadian institutions for physical culture, I may say that the actual methods of free movement cause a considerable waste of time and energy, while exaggerated sport easily ruins the body and the mind.

We can compare man's organism with a harp; its strings must be capable of response to most delicate vibrations, and yet produce sonorous sounds. Our body and mind follow in the ordinary daily life a few trodden paths, smoothed over by our habits and routine. The major part of our physical and mental faculties lies inert during our whole life, hidden even from ourselves. We hardly realize what enormous treasures are dormant within us. We must by proper exercises bring them to the surface and learn how to make use of them. An average man knows little of how to control his muscles and thoughts. He is just like a child who tries to play on a musical instrument without the proper training. Most of our movements are ugly, useless and take too much energy, only because we have no technique of the body. Even the carrying of loads by a porter is an art, for it involves getting the maximum of strength from the minimum of strain.

It is the same with our thinking. We are accustomed to use a set of ideas like small change, without even realizing their true meaning. Our attention flows through a few channels presented by our daily life, while real spiritual treasures are passing by unobserved. Inertia reigns in our body and mind, and the chief aim of self-development is to overcome this. Only then will an average man become a *real* man,

all of whose faculties will be tuned like the strings of a harp, and whose whole life will be sonorous. The normal tension of our mental and physical strings means health, and man must know how to reach this tension and how to use the strings. The art of living requires its own technique of body and mind.

Self-training can be based on various principles, but the most general ones are always the best. They apply equally to the building-up of health, the study of music, or to the development of psychic power. Let us see how the processes of our organism are controlled.

All the processes in cells, *i.e.*, building up their bodies, their prolification, special functions to which they are destined as parts of an organ, their struggle against pathogenic agents, etc., are under the immediate control of the nervous and the endocrine systems. These two systems can stimulate or depress various functions of the organs, acting also in this way one upon another. The normal tonus of a cell is reached by the counter-balance of controlling impulses. The cell in the state of the normal tonus functions regularly, intensively and rhythmically in harmony with the whole organism, showing the maximum of resistance to any destructive agent. In the case of a disease the cell loses its normal tonus and becomes more susceptible to external influences. Thus, the control of this tonus by the activity of the nervous apparatus is of first importance in preserving the health of a cell and raising its resistance. This activity can be direct—through the final branching of nervous trunks in the cells; or indirect—through a stimulation or depression of the activity of other organs.

Hand in hand with the question of health stands the question of longevity. Every physiological tissue has its own life-cycle, which is limited to a short number of years. That is to say, every tissue is completely regenerated in all its cellular elements to the end of this cycle. Such a regeneration takes place in the human organism several times during man's life. It is clear that under such a condition he should live eternally without even undergoing the process of aging. But this process, and the inevitable death, can be understood if we realize that of all our tissues the nervous one has the longest life-cycle, probably equal to the full duration of man's life. With years, the nervous cell wears out and its controlling function declines. As a result, the manifold activities of other tissues are also lowered. Apparently, the normal tonus is changing, and the life-balance is disturbed as processes of molecular disintegration and accumulation of inert material in the body takes place. The proliferative function suffers also. Every new generation of cells becomes weaker, while destructive processes in them are more pronounced. Accordingly, the psychic life of a man becomes more and more inert. The general resistance of the organism is lowered and the feeling of senility is a feeling of continuous fatigue.

The length of an individual human life in big cities, where people lead a strenuous nervous existence, though in other respects live in hygienic conditions, is, on an average, lower than that of the most backward, underfed peasants. The intellectual

work, the rush, thrill, amusements, worries, excitements, brisk movements, sounds, etc., of our big cities quickly wear out man's nervous system. The nerve cells under a continuous strain lose their normal tonus; their protecting and isolating layers become thinner. As a result, the cells become more irritable and are more quickly exhausted. The other tissues, with the loss of the normal nervous tonus, lose their own tonus also. The whole metabolism in the organism is now disturbed, and the physical and psychic forces quickly decline. The food and the air of big cities are too often blamed for premature aging. A young, healthy organism can thrive in far worse conditions. It is really surprising to see how the human organism can adapt itself to the most anti-hygienic conditions without being apparently affected by them. On the contrary, normal strain upon man's body and mind increases their strength. This is the fundamental principle of developing physical and psychic forces. An American statistical study of the Shick Test showed that in slums of big cities, with their miasmas of germs in the air, the resistance of children to diphtheria is higher than that of children in the country. Physicians, who more than anyone else, are always coming in contact with pathogenic organisms, apparently acquire some kind of general immunity. There is no doubt also, that the fear of a disease lowers the natural resistance of man.

I want only to show, with these examples, that the principle of a "happy medium" must be applied in questions of general hygiene. A too careful avoidance of pathogenic agents is just as bad as an excessive braving of them.

Thus, a living organism finds its physical as well as psychic optimum when it has to overcome some moderate obstacles or to show some resistance to external impulses. The force is forged in struggle and strain.

The nervous strain laid upon average man by city life appears to be excessive for his undisciplined and insufficiently fortified nervous system. Like muscles, the nervous system needs certain exercises to develop its resistance. These exercises will not only preserve or re-establish the normal nervous tonus, and with it the normal tonus of other organs, *i.e.*, the physical and mental health, but also develop the various faculties of man. Any exercise acts first of all upon the elements of both the central and the peripheric nervous systems. The technique of a musician or of a dancer produces well-developed centers and passages for nervous impulses. This means not large muscles, which every porter has, but quick and correct mental orders and differentiated nervous passages, by which they reach the respective muscles. Thus, the technique lies in the brain and peripheric nerves, and exercising means mainly a coining of correct and quick nervous impulses out of an undifferentiated mass. As a result, only the necessary muscles are used, relieving others from useless strain.

In a similar way new faculties can be developed. Most of the people of our Western society who possess extraordinary acuteness of mind and senses, and often the so-called "occult power," show also pathological symptoms. But all these faculties can be developed in a normal way by means of tenacious work on body and mind.

Various yogas teach methods of acquiring psychic power over matter and spirit. To understand this we must realize how the nervous system is constructed. It consists of two distinct parts: sensory-motor and autonomic. The former consists of the brain and spinal cord with their peripheric nerves. Its functions are as follows: higher psychic processes, receiving of sensations from the outside, command of the skeletal muscles and control of internal organs. Most of these functions are conscious and can be controlled at will. The autonomic part of the nervous apparatus is divided in its turn into two systems: the sympathetic and the para-sympathetic. The first consists of two chains of ganglia which furnish nerves to the spinal cord, most of the internal organs, blood vessels, eyes, etc. Among its numerous functions the principal ones are constriction of peripheric blood vessels, acceleration of pulse, inhibition of activity of the gastro-intestinal tract and of various secretory glands, dilatation of pupils, etc.

The para-sympathetic system consists mostly of a pair of vagi nerves. They are cranial nerves and give fibers to the heart, lungs, throat, gastro-intestinal tract, etc. Their functions are to slow down the pulse and respiration, stimulate the intestine, stomach and various secretory glands, contract the pupils, etc. Both the sympathetic and the para-sympathetic systems control the subsconscious functions of the body and convey vague sensations from the organs to the brain. To a certain extent they are antagonistic one to another. They work independently from will and consciousness, but are united to the sensory-motor system by numerous branches. A projection of conscious impulses through these communicating passages to the internal organs, and their subjugation to man's will, is the aim of Hatha-yoga. Respiration exercises serve best for this purpose. In fact, lungs are supplied both with vagi and sensory-motor nerves, thus bridging the gap between the autonomic and conscious systems. The process of respiration in its turn is closely united with functions of the heart and the abdominal organs. Dividing the respiration into different stages and assuming certain postures, yogis are able to excite through conscious movements and pressures various autonomic nerves, especially the n. n. vagi. After a long period of such exercises, combined with mental concentration on them, yogis arrive at the point where they can intensify the excitability of these nerves and create conditional reflexes and, probably, also conscious responses of internal organs to thought. This enables them to produce at will such unusual physiological phenomena as the stopping of the pulse, the contraction of the smooth muscles of various organs, etc. The main features of these exercises are the slow rhythmic movement and concentration.

Other yogis are not satisfied with this bodily technique and develop such psychic powers as telepathy, foretelling, suggestion, exteriorization of thoughts, etc. The physico-mental achievements of Hatha-yoga are regarded here not as a final aim, but as a preparatory step to the spiritual development. The appropriate physical exercises, combined with rhythmic breathing, rhythmic chanting of prayers and mental concen-

tration, serve to strengthen the body and the mind and to develop a potential psychic force. Further, certain psychic exercises aim to sensitize the perceptibility of man and to increase his ability to concentrate his attention. The former is accomplished partly by the previously mentioned physico-mental exercises, combined with the suppression of bodily desires and sensations, which inhibit spiritual impulses and distract attention; partly by special exercises in contemplation. Thus, the perceptibility is intensified in a certain chosen direction and therefore becomes concentrated. A concentrated thought has in itself little of actual psychic power. The thought acquires this power mainly from its emotional background. In fact, the psychic power is a power of emotions or higher feelings, which are concentrated and intensified in the direction of a given thought. If the example of a steam engine may be permitted here, the engineer opening the valve would be the Free Will; the cylindrical shape of steam necessary for the latter's condensation and direction, the Thought; and the pressure of steam, the Feeling. Psychic power can be materialized through any kind of emotion or thought if it is sufficiently concentrated, as in the case of magic and sorcery.

But the spiritual preparation of man, synthetic thoughts and such feelings as love, union, desire, faith, etc., toward a subject of such a thought represent by their all-embracing, deep, volitional and absorbing nature, the largest reservoir of psychic energy. That is why all the highest religions and esoteric teachers require of their disciples the abnegation of a worldly life and the development of a loving, ethical spirit. These disciples are only permitted to use their acquired psychic power for good and unselfish purposes, partly from religious considerations, but also because an attempt to use this power for other than altruistic purposes would ruin it. Indeed, in many such cases the psychic power would not develop because of the lack of a spiritual background.

I do not intend to give here explanations of various psychic phenomena which can be produced by Rāja-yogis. It would lead us too far from the subject, to the ground of philosophy where we should study the question of space, the theory of knowledge, etc. It is enough for us to know that various psychic qualities can be developed by proper education. It must be incessantly repeated that life is an art in itself, which requires a special training of the whole nervous apparatus. We can develop our muscles, nerves, mind and spirit by teaching them just as a mother teaches her child to dress itself. No matter what is to be developed, whether muscles or mind, or for what purpose—be it to acquire health and intelligence, or a virtuosity of the fingers, autonomic nerves or psychic power, etc., the principles of teaching are the same; the difference lies only in the type of exercise.

There are three general principles: the union of the physical and mental apparatus, rhythm, and exceeding slowness in exercising. To these should be added the principle of physical and mental relaxation as a period of rest and re-accumulation of forces.

Union of Physical and Mental Apparatus. We have seen that the main factor in developing the body is the sensory-motor nervous system. Its nervous trunks comprise two kinds of individual nerves; afferent, which carry sensations from the periphery to the brain, and efferent, which carry motor impulses in the opposite direction. Thus, muscles, nervous trunks and the brain are united in one system. Touching one end of this system we induce a response at the other end. The mind can produce a double action upon the body: (1) it can develop, by attentively controlling a chosen movement of the body, the physiological tonus of the peripheric nerves, muscles and internal organs dependent on this movement; (2) a general benefactory influence may be exercised by concentrated thought and self-suggestion on a given part of the body. This activity of the mind is good training for the mind itself. Moreover, concentration of attention upon an exercise is necessary to make it rhythmic and uniformly slow.

The exercising muscles in their turn act favorably upon the mind by sending rhythmic sensory impulses to the brain and by intensifying the general metabolism; "*Mens sana in corpore sano.*"

The attention following a movement, becomes easily attached to it. Thus, a movement connected with a thinking process helps it to become concentrated, steady and gradual. If in physical exercises the mind must follow a movement, in some mental exercises, in its turn, the movement, real or imaginery, must follow the thought.

Rhythm. The importance of rhythm in physiological processes and in physical and mental exercises is not yet fully appreciated. Rhythmic movement or thinking is an organized process. Every such process continues pulsating: accumulating and discharging its energy and thus maintaining its equilibrium. These two periods form a cycle, more or less extended in time and space, and characteristic of the given process. These cycles can be exceedingly short and then we call it vibration; they may also be of cosmic proportions. All processes of the universe, physical, biological and psychological, have their cycles. In a sequence of cycles the corresponding moments mark the rhythm. Therefore, our thoughts, feelings, nervous impulses, movements, and organic functions are impregnated with rhythm. Our mind is very sensitive to rhythm and falls easily under its influence. This is proven by the influence of music and the difficulty which we experience in trying to combine two different rhythms. The longer and the smoother the cycles of a process, the less distinct is its rhythm. Sometimes it is possible to emphasize the rhythm by accentuating the corresponding moments of each cycle. There are two kinds of rhythmic processes; one represents a process degenerated into or formed of a sequence of accents or sharp movements, interrupted by equal pauses, as in falling drops. We find this also in certain physical exercises. The other represents a continuous movement, marked by evenly distributed accents, as in the case of a moving train over the knocking joints of the rails. The great majority of vibrative processes, including those in the living body, belong to the latter kind. Here, the pauses between accents

are filled in with unceasing movement, while in the former process, short movements are separated by empty pauses. Both processes require an equal sense of rhythm, but in the case of the continuous process, the sense of rhythm and the accentuating force are more intimately united. Moreover, in this process, the accents do not fall on empty pauses, but on a tense ground, thus coining it rhythmically. In physical exercises, this process offers the additional advantage of using for accents different muscular groups, thus educating each group separately. By acting upon a process in harmony with its rhythm, we can to a certain extent acquire control over the former and intensify or enlarge upon it at will. In fact, the rhythmic breathing of yogis, the chanting of magicians, the movements in ordinary physical exercises, etc., are evidences of the tremendous importance of rhythm in developing the various psychic and physical faculties of man.

It is not requisite in exercises for self-development, to catch the physiological rhythm of a given organ. We can impose upon it our own rhythm of volitional impulses, because body and mind adapt themselves most easily to these. Indeed, physiological processes are so complicated, that any superimposed rhythm will harmonize with them, except in the case of a few functions of some of the internal organs. As the present method is based upon the development of the nervous system, it is very important to make peripheric nerves responsive to various rhythms. At the same time the mind should be taught to control the combination of the different rhythms of simultaneous movements of different parts of the body. In this way the mind will be trained not only to feel rhythm, but also to exercise its full power of attention in various directions at once. Though various schools of physical culture begin now to appreciate the importance of developing the feeling of rhythm, the necessity of thinking rhythmically is not yet understood. But rhythmic thinking means an activity and discipline of the mind, and one must make a habit of it.

There are three types of the wrong thinking process: the dull thinking of uncultured people; the loose thinking of undisciplined, superficial minds, as that of children and some nervous people; and the impressionable thinking of many brilliant writers, speakers, etc., who are actually hypnotized by some attractive ideas or images and are carried along these channels without verifying them. We see in all these types the failure of man to govern his thoughts, just as a novice in music fails to control his fingers. But the will coins rhythm in the thinking process as well as in conscious movements, thus gaining control of them.

Moreover, we can speak about the rhythm of soul and mind in general, which means that all their functions are well balanced. It is this generalized rhythm that creates one's personality and is probably responsible for health, longevity, success, and psychic power. The chief aim of the present method is to develop such a rhythm. It is developed, not as the result of one or another exercise, but in con-

sequence of an acquired habit to govern body and mind, and to lead an intensively spiritual life.

Slowness. An exceedingly slow tempo is essential in every exercise. In order to keep the movement of any part of the body very slow, at least two opposite nervous forces are called upon: one is contracting the muscles, the other, intimately related to the first, is incessantly restraining this contraction. Thus, a slow and naturally uniform motion requires the height of nervous tension. One can see at once how difficult and tiresome is a slow movement. The degree of the muscular fatigue after a very slow exercise is greater than after the same exercise done at an ordinary speed during the same length of time. This fatigue is caused: (1) by the fact that our undisciplined muscles and nerves work by sharp jumps and an additional energy is required to control these jumps, smoothing them into a continuous, uniform activity; (2) by the fact that in a quick movement, part of the work is done by inertia, which is almost nil in the case of a slow movement. Thus, in slow exercises, muscles and nerves are especially active and the nervous system is undergoing an intensive training.

A slow, uniform movement requires the rhythmic nervous impulses of the sensory-motor system and an intense concentration of attention. On the other hand, a slow movement is required, that there may be time: (1) for the concentration of attention upon it; and (2) for placing several rhythmic accents during the whole period of motion.

Thus, exceeding slowness in exercising, accentuated rhythm, and the concentration of attention, form a self-supporting triad of the fundamental principles. This triad incites the consciousness of one's body, which is of particular importance in self-development.

Relaxation. The counter-part of this triad is relaxation. An undisciplined nervous system is continuously in the reversible state either of an over-strain or of an under-strain. It is not able to keep its normal tonus. That is why the strenuous life in big cities results very often in a nervous break-down, and all neurasthenic people have their "ups and downs." A normal tonus requires normal rest. This is another element of physiological and psychic rhythm. But relaxation is important not only as a rest, when we accumulate again our physical and psychic forces; it is easier to start anew a right muscular movement or a right thinking process when we are not influenced by a pre-existent physical or mental strain. For instance, a relaxed arm will lift an object in a natural, well-balanced manner, using only the necessary muscles, and thus performing an economical and graceful movement. On the other hand, most of an average man's movements and gestures are ugly and consume too much energy because of neuro-muscular over-strain.

It is the same with the mind. "Night brings counsel" not only because it brings rest, but also because it interrupts the fixed trend of thought. Moreover, the period of rest is not simply a period of accumulation of forces, but also a period of a latent fixing and arranging of newly acquired knowledge. Every musician, dancer, athlete, etc., knows that after strenuous work, a rest for several days brings paradoxically some technical improvement. Similarly, scientists very often find suddenly the right solution of a problem after a mental rest, following a period of intense and apparently fruitless thinking. It is evident that some latent work is going on in the muscles as in the brain during the period of rest.

If there is an art in action, there is also an art in relaxation, and the latter is no less important. It is difficult, especially for a nervous person, to relax his muscles, but probably it is still more difficult to relax his mind, which works even during sleep. And an expenditure of psychic energy has far more effect on general health and is retrieved with far greater difficulty than an expenditure of muscular energy. One must train oneself in relaxation. But it must be remembered that as there is over-strain, there can also be over-relaxation. When relaxed too long, nerves and muscles gradually lose their physiological tonus and an additional energy is needed to bring them to their normal state. There can even be a real atrophy of the muscle in the prolonged rest of a limb immobilized by a cast. The relaxation required is a strictly necessary rest, but not a self-indulging. One must be trained not only to get the maximum of rest from the minimum of time, but also to know the length and frequency of rest required in every kind of work. Short, frequent but complete, partial or general relaxations, physical and mental, are necessary during the day. It was recently proven at a textile factory in America, that a few 5 to 10 minute intervals in work for a complete rest increased the daily production of the factory, notwithstanding a considerable shortening of the time of work. It is very little understood by business people that frequent short rests during their own or their employees' work will but improve quantitatively and qualitatively its results.

One must make the most of the night's sleep by avoiding any mental strain before retiring and by sleeping in a soft and warm bed. I have mentioned the necessity of a regular interruption or change of work for one or several days. People with various interests in life usually exhaust their nervous system less than those concentrated in one direction.

Each of the physical exercises described below should be followed by the relaxation of the exercising part or of the whole body. This relaxation does not mean merely a simple rest, but a temporary loss of the tonus. There are special exercises in relaxation to enable one to reach its highest degree.

The same applies also to mental work, and it is a great achievement to be able at will not to think or to feel. This is an important step in spiritual self-development.

Exercises. It is clear from the aforesaid, that the importance of the method here prescribed, lies not so much in the selection of definite exercises, as in the manner of performing them. The exercises should be followed only in the main, and everyone may choose those exercises that suit best his purpose. The purposes may be diverse — the development of technique by musician or dancer, the yogi's acquirement of power over the internal organs, or therapeutic action upon some diseased internal organ, etc. In each of these cases there are appropriate exercises and it can only be recommended that they be done according to the principles given above.

The exercises for the general development of body and mind can be divided into three groups, physical, mental and spiritual, which should be intermingled and repeated several times a day, in order to keep the body and the mind tuned-up and to develop gradually the habit for it. The periods of exercising should not be long, no more than 5 to 10 minutes at a time, and the best results are obtained when done in privacy with nothing to distract the attention. No music should be allowed, because it makes the keeping of rhythm passive and too easy. The work consists of a real study of one or another exercise, as a musician would study a passage of music, until it can be performed without the excessive strain which comes from imperfectly differentiated nervous or mental work. The importance of the absolute cooperation of body and mind, creating on the one side a feeling of immersion in thought and on the other side a consciousness of the body, must be emphasized. In this way the harmony of body and mind and the power of control over these are gradually developed.

Physical Exercises. These can also be arranged in three groups according to their difficulty. The exercises of the first group are separate movements of one or another part of the body; those of the second group — combined asymmetrical movements of two, or more parts simultaneously at one and the same rhythm; those of the third —combined asymmetrical movements as above, but at different rhythms. The combinations of rhythms may vary from the simplest to the more complicated, as 3:4, 4:5, etc. All the muscles of the limbs, trunk and neck must be exercised. For this any ordinary exercise will be good, but in order to save time by using a variety of muscles in a single exercise, circulatory movements may be especially recommended. The latter, moreover, result in a better balance of muscular action and therefore, in more intense attention than straight movements.

In regard to slowness of movement. It should take from one-half to two minutes to raise an arm from its position along the side of the body to a horizontal position at shoulder-height, and every other exercise should be timed on the same basis. The movement must be uniform, the slightest jump or acceleration should be carefully avoided, and the attention focused on describing a regular line. These conditions are very important because they require a strict control of the movement and very tense muscles.

The rhythm should be marked during the movement by slight, short efforts made by some muscles of the moving part, without interrupting the general movement or changing its speed or line. Thus, nervous impulses to various muscles gradually become highly differentiated. We can train every muscle to respond separately to conscious impulses, increasing in this way the cooperation of body and mind.

The attention must be concentrated upon each movement, controlling its slowness, uniformity, line and rhythm. It is advisable for this purpose to follow the moving part with the eyes, against a wall, the floor or an object in the room. A relaxation of the working muscles must take place after each complete movement, when the part of the body returns to its starting point. The resting part should take a position either lying on a support or freely hanging in the air, so that every muscle may be completely relaxed and that part of the body present no greater resistance to any foreign action upon it than that of its dead weight. It is best, in order to assume this relaxed state, to throw the exercising part briskly about, letting it take its own most natural resting position, and remain in it. It is necessary together with the relaxation of the muscles to relax also the attention, letting it wander aimlessly over surrounding objects, never fixing upon any of them. The muscular and mental relaxation must be short but complete, and then a new exercise is to be started. Usually nervous people cannot relax entirely, but it is important to develop through practice, the faculty of complete relaxation at will.

Mental Exercises. It has already been pointed out that our mind can be trained as our muscles. Every thought can be handled as a musician handles his fingers. The technique of the mind consists of acute, active, though controlled, thinking and of the ability to concentrate the attention at any intensity on any one object or on several objects at once, and then to shift this attention freely from one object to another.

In mental exercises, as in physical ones, the greatest importance lies not in the selection of them, but in the way they are to be performed. The exercises can be divided into two groups: rhythmic observation and rhythmic meditation. Every exercise must be short (a few minutes are sufficient), but it should be repeated several times a day in between other occupations. The maximum of attention must be applied. The whole body during an exercise must be in a *very stiff* position, standing or sitting, with all muscles strained in order to keep the nervous system in tonus and to unite the feeling of one's body with one's thoughts.

Slowness in observation or meditation consists of a gradual transferring of attention from one detail of an object or one logical quality of an idea to the one closest to it. Rhythm in observation and meditation is requisite to make them active. The attention is fixed on each detail or quality for three to five or more seconds, while we

are mentally counting them (automatically), and then transferred to the next one for the same period. Thus the whole subject is gradually and uniformly studied. The further development of the mind consists in shortening the exercising periods without losing the sharpness or richness of the study. A teacher can guide his pupil by giving him some problem to observe or meditate upon for a short time, and then asking him to give a detailed and correct description of it. A variety of problems should be given.

Spiritual Exercises. A spiritual feeling, or life in general, may be characterized more or less as synthetic. Such concepts as God, Universe, Humanity, Beauty, or the Soul of a man, of an object, etc., are synthetic, and feelings of fusion with them, as those of love, desire, absorption, penetration, harmonization, etc., are spiritual ones. These feelings may be considered themselves as synthetic because they embrace the whole being of man as a psychic unity.

The aim of spiritual exercises is to develop the intensity of such a feeling of fusion with a given synthetic object. The more details enter into the representation of the object and the fuller the understanding of it, the more complete is one's fusion with it. The best method is to take the object of a mental exercise, thus completing the latter by synthesizing the object in all of its details, and revealing its "soul" and meaning. Later on the more synthetic and general subjects of meditation exercises should be used, especially those which have personal and ethical meaning.

Spiritual feelings are closely related to the synthetic feeling of one's body as a whole. We must be in a *very stiff* posture as in mental exercises, and be all the time conscious of the whole body. First we must visualize the object in all its details, passing from one to another until the whole picture is firmly and brightly fixed in the brain; then, we must strive to understand its "soul" and become fused with it through the feeling of love, absorption, etc. At the same time we must make a slow rhythmic inspiration by several short expansions of the chest, imagining that thus we absorb the object, and that the fusion with the object is increased with each portion of air. The air must be kept in the lungs at the height of chest expansion for some time, then briskly expired and the attention relaxed until the next inspiration, and so on.

These exercises, as mental ones, should not last longer than a few minutes at a time, exaggeration of them being dangerous; but they must be repeated every time a mental exercise is done. It is important to do spiritual exercises for some time with one and the same object, in order to acquire a deeper understanding of it and reach a more complete fusion with it.

The main aim of such spiritual exercises is to gradually create in man the habit of a bright and synthetic acceptance of the world, and to develop his power to concentrate his thoughts and feelings.

A teacher can, to a certain extent, direct the development of his pupil, based on the sharpness of the latter's description of the object and by his ability to understand its "soul."

Summary. The bodily and mental health and activity of a man, the length of his life, his success and intensity of living, depend mainly upon the state of his nervous system. The normal tonus of every tissue in the organism and therefore, their physiological optimum, depends directly or indirectly upon the normal tonus of the nervous system. Both function-complexes of the latter, nervous and psychic, play equally important roles in all physiological processes of the organism, and vice-versa. There is no doubt that such psychic phenomena as cheerfulness, courage, strong emotions, self-suggestion, faith, etc., have most important influences upon the body, and the power of thought is at present very little realized. In immediate connection with the question of preservation of health stands the question of the development of man's physical and psychic faculties. Man's care for his own being must have as its main object the training of the central and peripheric nervous systems. Schools for the development of psychic faculties are exceptions and their importance is not realized by the public. The schools for physical culture are on the wrong path, because in these, the training of the nervous systems appears to be an occasional by-product that scarcely attracts attention. There is the same deficiency in eurythmics, though here we meet with similar principles as in the present method, namely: slowness of movement, rhythm, attention and relaxation; but the application is different. In fact, only *exceeding* slowness and rhythmic accents placed *during* a movement and by separate muscles, have the full beneficial bearing upon body and mind. The whole method and the final aims of eurythmics are different from those of the present method. The latter probably stands in principle nearest to the Hindu yoga, which has proved during centuries its value in strengthening and developing the human organism.

The present method is designed to train the nervous and psychic systems. Thus, life is considered as an art that requires a special technique. The principles of this technique are applicable to any purpose: be it the preservation or re-establishing of bodily or mental health, the training of musician, dancer, athlete or yogi; or the development of mental and spiritual faculties, etc. The chief point of the method is the parallel development of body and mind and their close cooperation. Thus, physical exercises require concentration of attention, and psychic exercises, the participation of the body and a synthetic consciousness of it.

There are four principles in exercising: (1) concentration of attention on the exercise, (2) rhythm, (3) slowness, and (4) relaxation. The exercises can be done either by the student alone, or under the individual direction of a teacher. They should not be done longer than a few minutes at a time, but should be repeated several times a day. The work consists of the real study of an exercise, physical or psychic, until it becomes technically perfect and can be performed without excessive strain. The teacher or student himself can select the exercises which suit best their purposes, as the point of the method lies in the manner of performing the various exercises. No immediate result can be expected, but gradually, after steady work, a new "life-reality" will be developed, characterized by the feeling of power over body and mind similar to that experienced by a virtuoso over his hands, by a consciousness of body, and by the feeling of oneself in his thoughts. This synthesis of the physical and psychic nature of man represents a real power in the world which is not fully understood as yet in the West. There is practically no limit to self-development and this power grows with the spiritual achievements of man.

Although the present method does not touch upon the ethical problems of life, there is a connection between them similar to that of the musician's technique and his striving for artistic perfection. The technique of body and mind creates the joy of power and of internal harmony, and a desire for further perfection, thus forming a natural basis for ethics.

LOMONOSOV AND HIS CONTRIBUTION TO NATURAL SCIENCE

By VLADIMIR PERTZOFF, M. A.

INTRODUCTORY. *A French historian tells us that Lomonosov the poet, should not be confused with Lomonosov the scientist. This is hardly a true statement of fact, for in reality there was only one Lomonosov. He was not only an outstanding poet whose influence on the Russian language was quite as important in its way as the revolution brought about by Pushkin, a grammarian whose work survived almost a hundred years,—but also a scientist with remarkable powers of observation and unusual mathematical insight.*

Lomonosov, a contemporary of Benjamin Franklin and a forerunner of Lavoisier, was the first Russian chemist. Indeed, he may be called the founder of our modern physical chemistry.

A brief exposition of his life and his contribution to natural science will be found in the following pages.

MIKHAYLO VASILEVICH LOMONOSOV was born about the year 1711[1] in the village of Denisovka, which lies on a small island in the river North Dvina, opposite the town of Kholmogory. This town was historically important and was probably founded before the XVth century. In its early days it served as a trading-post of Novgorod the Great. As early as the middle of the XVIth century (1553) an Englishman, Robert Chancellor, had rounded the North Cape, had come through the White Sea and found his way up the North Dvina to Kholmogory, which was the only open port of Russia. After visiting the Tzar in Moscow and obtaining permission to trade and build warehouses, Chancellor returned home. Two years later he was back again with more ships, some of them belonging to Dutch merchants. As a result of the trade which was established at that time, the town of New Kholmogory was founded at the mouth of the river. It was this town that was later renamed Archangel, and it was here that Peter the Great began his first experiments in building Russian seagoing vessels.

Vasily Dorofeech, Lomonosov's father, though of the peasant class, was a well-to-do fisherman, owning several boats and, it is said, even one that was square-rigged. He used to go down the river and far out into the White Sea on fishing trips, often taking his son, Mikhaylo, with him. At Archangel foreign ships discharged their cargoes and their crews were seen everywhere on its streets. It is probable that the Lomonosovs often stopped there to trade and to purchase supplies.

1) Dates throughout this paper are according to the Gregorian calendar used in Russia.

Lomonosov was brought up in these surroundings. His horizon was necessarily far broader than that of his contemporaries in the heart of Russia.

Early in his youth, Lomonosov acquired a strong interest in natural science. In Kholmogory the opportunities for learning were very limited, and Mikhaylo was unable to obtain any books with which to satisfy his inquisitive mind. After much trouble he found a grammar by Smotritzky, and an arithmetic by Magnitzky. The latter was not only an arithmetic, but also gave an account of physics, geometry, astronomy, geography and navigation, written in popular form. These two books he learned by heart, and later referred to them as the "gateway of his learning." He felt that in order to study further, he must know Latin, the scientific language of those days. This could not be acquired in Kholmogory.

His home life, with a step-mother, was far from happy, a fact which probably influenced his decision to leave for Moscow. The County Record bears witness to his legal departure: "On the 7th of December, 1730, Mihailo Vasiliev Lomonosov is allowed to go to Moscow and to sea, until September 1731; in payment of his poll tax, Ivan Banev pledges himself."

Upon arriving in Moscow, Lomonosov entered the Slavo-Greek-Latin Academy, which had been founded in 1684 by Byzantine scholars who taught Latin, the Slavic language, geography, history, dogma and arithmetic. He writes as follows of his early days there: "While studying in the Spasky School (the Academy) I was filled with longings which diverted my mind from science. In those days I was struggling under an overpowering pressure. On the one side, my father, having only myself as a child, was writing to me that I had abandoned him, and that the wealth which he, with great labor, had gathered for me, would be plundered by strangers after his death. On the other side there was unspeakable poverty. Having one *altyn* (3 kopeks 2) per day as salary, it was impossible to spend more than one *denejka* (½ kopek) for bread and *kvass* (a drink), the remaining must go for paper, boots and other necessities. On the one hand, I received letters from home saying that people there, knowing of my father's wealth, would gladly offer me their daughters in marriage; such offers I had had while still at home. Yet, on the other hand, the students here, all small boys, pointed and shouted at me, 'Look at the numb-skull who comes at twenty to study Latin!' "

The salary received by Lomonosov was indeed meagre, but it must be remembered that in those days a kopek was worth far more than now. A pound of meat cost less than two kopeks. In 1741 Leonard Euler, the famous mathematician, sold his rather large house in St. Petersburg for three hundred roubles,[2] and was very much pleased with the transaction.

Despite his poverty, Lomonosov was able to continue his studies, for kind friends at home sent him food, and at times, money.

What were those studies? In these days of questionnaires and psychological

2) The rouble — 100 kopeks. The pre-war value of the rouble was about 50 American cents.

tests, it is interesting to know what sort of questions were put to students two centuries ago:

"Where were the angels created?"

"Can they move themselves, and can they move other bodies?"

"How do they communicate with one another?"

"How much space is occupied by an angel?"

"Why do old men lose their hair, and why do not women grow beards?"

In the light of the above questions, it is not surprising that in 1734 Lomonosov went to the Theological Academy in Kiev, where he hoped to study more mathematics and physics. Again he was disappointed, and a year later returned to Moscow, quite undecided what to do next.

Fate was kind to him. The President of the Academy of Science, founded by Peter the Great, was looking for a chemist who also knew metallurgy and geology. He wished to send him on an expedition into Siberia to explore its natural wealth. Since such a man could not be found in Russia, it was decided to send a few able students abroad to be educated in these subjects. Fortunately for Lomonosov, he was one of those who was chosen.

In 1736 the students set off for Germany: first, to the University of Marbourg to study natural sciences under Professor Christian Wolff, and then on to Freyberg to perfect their knowledge under the guidance of Bergrat Henkel. Their stay abroad was full of semi-tragic elements. In the free atmosphere of German student life, much time was devoted to gayety, which entailed the spending and consequent borrowing of money. Upon their departure from Marbourg, Professor Wolff wrote the Academy: "While they were here, they terrorized everybody. People were afraid to say anything against them. Their departure has freed me from much trouble." In spite of these diversions, the studies at Marbourg left a profound impression on Lomonosov's mind, and it was there that he became well grounded in the fundamental sciences.

At Freyberg life was more peaceful, though money was still lacking. After paying the debts in Marbourg, the Academy was loath to send more. Not long after this, Lomonosov decided to return to Russia. On the way home he married Elizabeth Filch, the daughter of a member of the City Council of Marbourg. He left her temporarily in Germany, and after many incidents of lesser importance, finally arrived in St. Petersburg.

The ensuing period of Lomonosov's life is closely associated with the fate of the Academy of Science. The idea of an academy of science was probably suggested to Peter the Great by Leibnitz, who also drew up a plan for the dissemination of Western civilization in Russia. However, it is Christian Wolff to whom we are indebted for assistance in carrying the project to a practical end. Wolff favored the foundation of a university where Russians could be trained as scientists, rather

than an Academy where Germans (the only scientists available) should be installed at once. The actual plans, which were essentially a combination of the two ideas just mentioned, were drawn up by Blumentrost. The Academy was to include a high school and university, as well as the Academy itself.

Peter the Great did not live to see his plans completed. His wife, Catherine I, officially opened the Academy in December 1725, and appointed Blumentrost its first President. However, it was Christian Wolff who chose the scientists for the Academy and their high standing may be judged by the names of some of the first members: Herman, Nicholas and Daniel Bernoulli, Bilfinger, Bayer, De l'Isle and later Euler.

It was in the summer of 1741 that Lomonosov arrived in St. Petersburg, and with the help of the all-powerful Secretary of the Academy, Schumacher, he was appointed Assistant in Physics, with a salary of 369 roubles per annum. Two years later Lomonosov's wife came from Germany, and in the year of 1745, another important event took place in his life—he was appointed Professor of Chemistry, thus becoming a Member of the Academy.

The years preceding Lomonosov's last appointment could hardly be called peaceful, either for himself or for some of the other members of the Academy.

On the 25th of November, 1741, Elizabeth (daughter of Peter the Great) ascended the throne. The reign of the all-powerful Baron, of German extraction, was ended. With his fall came the patriotic cry: "Down with the Germans." A wave of patriotism caused dissensions in the Academy.

Lomonosov took the lead in this drive against the Germans, with a rather primitive enthusiasm. In the autumn of 1742, he had a fight with Sturm, the German gardener of the Academy, in which he inflicted with his fists, a severe beating on Sturm himself, his guests, his wife, and his servants. This year and the following ones, Lomonosov spent mostly under arrest. Not long after this, an acquaintance, Goloubtzov, complains that "Lomonosov struck me with a candelabra in the face which gave me a pain in my eye and a gash on my face so that I could not appear in public."

Stories of this sort are numerous, and unquestionably illustrate Lomonosov's inability to curb his discontent without physical action. But such a lack of civilized tradition was characteristic of Russians in those days, and especially of people of Lomonosov's type, who broke away from the traditions of Holy Russia, and had not yet acquired enough of any other tradition.

Before Lomonosov, the Chair of Chemistry was held by Burger, who came to St. Petersburg in 1726. All that is known of him is that on July 22nd of the same year, going home from a visit, he fell from his carriage and was killed. The next "chemist" was a botanist, Gmelin. Soon after his appointment he went on an expedition to Siberia, where he stayed for eleven years. After his return to

St. Petersburg, he spent all of his time classifying his valuable botanical collections. It is evident that both of these "chemists" contributed nothing, either to theoretical or experimental chemistry.

Upon his appointment as Professor of Chemistry, Lomonosov realized the necessity of building a chemical laboratory. In the summer of 1746, permission was granted him, and two years later, a laboratory was erected at a cost of about $650. It contained three rooms: one with a stove and hood for manipulations involving heat, another serving both as a class and balance room; the third was used as a storage room. In this laboratory Lomonosov performed numerous experiments and here he delivered what he called a course in physical chemistry, the first course ever delivered in this science.

From this time on Lomonosov's activities were not confined to science. He compiled a Russian grammar, the first to contain a scientific and well-built theory of the language, and also wrote a history of Russia, though complaining that it took him from his chemical experiments.

Another of his activities was the making of mosaic pictures. Between the years 1749-1751, he performed more than 2,200 experiments in order to develop a method of staining glass. He was finally successful in 1753, and organized a factory for the making of mosaics. The factory produced rather unusual works of art; several of the pictures are extant at the present time.

The desire to spread education in Russia, which perhaps may be called the moving factor in all of Lomonosov's activities, led him to the idea of opening an institution of higher learning in Moscow. Though the project was executed by Count Shuvalov, Lomonosov drew the actual plans for the organization and administration of the University of Moscow (founded in 1755).

The last years of Lomonosov's life were disturbed by much administrative work, in which he had to fight the intrigues and moves of his enemies, who plotted with far greater ability than Lomonosov ever could muster. It is the very honest man who always loses in politics.

On April 4th, 1765, Lomonosov died of influenza. His body lies buried in the Alexandro-Nevsky Monastery in St. Petersburg.

Contribution to Chemistry and Physics

Soon after Lomonosov's return from abroad, he wrote the *Elements of Mathematical Chemistry*, (1741). According to him, chemistry is a "science of changes occurring in a complex body. . . The theoretical side of chemistry consists of a philosophical understanding of changes occurring in complex bodies. A true chemist must always be a philosopher. Those who busy themselves only with the practical side, are not true chemists." (1)[3]

In the same treatise we find the following definitions:

"An element is part of a body consisting of no smaller different bodies."

3) The figures in parentheses refer to bibliography at end of article.

"A corpuscle is a segregation of elements in a single small mass."

"The corpuscles are homogeneous if they are composed of the same number of the same elements bound in the same manner."

"A compound body consists of two or more different elements, so bound to each other, that in every separate corpuscle there is the same proportion of elements (of which the body consists) as in the whole compound body, among all the elements." (2).

If we replace the word corpuscle by the word molecule, the above definitions might equally well be found in any modern text-book on chemistry.

"All changes in bodies come from motion . . . motion may be explained by the laws of mechanics. . . . He who wishes to penetrate chemical truths deeply, must necessarily study mechanics. Since the knowledge of mechanics presupposes the knowledge of mathematics, he who strives to undertake an intimate study of chemistry must know mathematics thoroughly." (1).

"Many deny the possibility of basing chemistry upon the elements of mechanics and make of it an exact science. . . . If those who obscure their days with smoke and soot, and in whose brain reigns chaos from a mass of experiments which have not been thought through, would deign to learn from the divine laws of geometricians . . . unquestionably they would penetrate deeper into the mystery of nature. In practice, mathematicians derive many truths from the conjunction of a few lines: why cannot the chemist derive even greater laws from the abundance of existing experiments? I can find no reason, except their illiteracy in mathematics." (1).

"I hope you will inquire here, why up to the present time, students of natural science have made so little progress. I will answer that for this study, an able chemist and profound mathematician, all in one man, is needed. The chemist must be one who understands his science, not only from reading books, but by using his own hands diligently."

"The eyes are useless to him who cannot open a thing with his own hands. The hands are useless to him who has not eyes to see that which is within. Verily, chemistry may be called the hands and mathematics the eyes of physics." (3).

These quotations need little explanation. In addition to his philosophical statements, there is abundant evidence that Lomonosov not only preached the doctrine of physical chemistry, but also practised it. It is to him that we are indebted for a systematic use of weight and volume in physico-chemical work.

One of Lomonosov's students, Klementiev, in a dissertation presented to the Academy on the 26th of April, 1754, quotes his teacher as saying: "I think there is no scientist who does not know that there exist innumerable chemical experiments, but at the same time, would not deny that the authors of practically all of them pass over in silence such important and essential particulars as volume and weight. . . . However, without a knowledge of volume and weight, we cannot reproduce with

any certainty the desired phenomenon, even though it has been obtained before by others." (4).

A more intimate picture of Lomonosov's experiments may perhaps be obtained from other sources. In a report (1745) on the building of his chemical laboratory, Lomonosov describes his future experimental work. He emphasizes the use of "pure substances." "Substances required for chemical work should be purified with all care in order that there may be no foreign admixture . . ." Then it is necessary "to investigate the specific gravity of native and produced substances. . . . Parts of substances in small quantities and all others, where it is possible, should be examined under a microscope. . . . Chemical experiments should be supplemented by optical, magnetic and electrical ones, because, not only from the experiments of others, but also from my own experience, I have come to the conclusion that only when chemical experiments are united with physical experiments, are they especially effective." The report ends with a statement that "in all the above mentioned experiments, I will note and write down not only the effect of the weight and volume of the substances and vessels used, but also the environment itself. . . ." (5).

From 1751-1753, Lomonosov delivered a course of lectures, which he called "True Physical Chemistry." Physical chemistry according to him "is a science explaining on the basis of physical laws and experiments, changes occurring through chemical operations in complex bodies." (6).

Lomonosov proposed to make the physico-chemical investigation of aqueous solutions of salts, under the following headings:

(a) Solubility at different temperatures.
(b) Density of saturated solutions at different temperatures.
(c) Increase of volume during dissolution.
(d) Lowering of temperature in process of dissolution.
(e) Expansion of solution from 0° to 100°.
(f) Ebullition temperature of solutions.
(g) Heat capacity of solutions.
(h) Dissolution of salts in saturated solution of other salts.
(i) Congelation of solutions.
(j) Refraction of light in solutions as compared with that of water.
(k) Rise of solutions in capillary tubes.
(l) Microscopical observations of solutions.
(m) Action of electrical force on solutions.
(n) Color of electrical sparks produced in solutions.
(o) Crystallization of solutions and investigation of crystals obtained.
(p) Deliquescence of salts. (7).

Little is known about the realization of this gigantic program. Without any doubt, we must agree that this program lies at the very base of our physico-chemical

knowledge and, we might conclude with little hesitation, that Lomonosov has well earned the title of the founder of physical chemistry. His other contributions perhaps bear no less prophetic witness to this fact than the foregoing outline. Possibly, Lomonosov's greatest single contribution is his mechanical theory of heat and certain applications which he was able to derive from it.

His basic supposition is not original. Lomonosov, like others before him, assumes that matter is composed of indivisible small particles or molecules. He refers to them as "insensitive particles," trying to emphasize by this name the impossibility of acknowledging the existence of such particles by direct means. According to Lomonosov, these particles are spherical and are in continuous rotary motion. In his "Reflections upon the Cause of Heat and Cold," (Section 9), he speaks of his theory as follows: "Motion may be general, when a body changes its place, and internal when there is motion of insensitive particles of matter. Consequently, heat consists of the internal motion of matter." (8). This supposition is further developed in the "Discussion of Solidity and Fluidity of Bodies" (1760): ". . . . from the theory of rotary heat-generating motion it follows that the particles of warm bodies revolve faster (than those of cold bodies), and strike each other with greater force. Consequently, their adhesion decreases, the more warmth or heat the body possesses. It might be heated to such an extent that it would not only be transformed into a liquid, but its particles being separated and having lost mutual contact, would be dissipated into vapor . . ." Where is the lower limit of heat? ". . . . According to the theory of heat-generating motion, the body has heat so long as its particles move in rotary motion, even though they may seem cold." (9).

We have here all the basic conceptions of kinetic theory and its application to the phenomenon of liquefaction and evaporation, and perhaps even a notion of the absolute zero.

Following the same trend of thinking, Lomonosov comes very near to a fundamental conclusion, which is known at present under the name of the Law of Conservation of Mass and Energy.[4] "All changes occurring in nature are such that when something is taken from one body, as much is added to another. So, when there is a decrease somewhere in matter, there will be an increase in some other place: for as many hours as one stays awake, by just that number of hours has one's sleep been curtailed. This general natural law projects itself into the rules of motion, because when a body by its force moves another one, it loses as much force as it communicates to the body receiving the motion." (10).

The first part of this statement cannot claim originality, since Roger Bacon (1560-1626) in his *Novum Organum* comes to a very similar conclusion: "There is nothing more true in nature than the double proposition that nothing is made from nothing, and nothing is destroyed. The true quantity of material, or a total sum of it, remains invariable, not increasing or decreasing." The second half, dealing with motion, is

4) First expressed in a letter to Euler on the 28th day of November, 1748.

of greater interest, though foreshadowed by Newton's experimental law of impact. The question is, what did Lomonosov mean by "force of motion." Unfortunately we do not possess any more accurate definition by him, but we have indirect evidence indicating that Lomonosov meant the quantity of motion, *i.e.*, the product of mass and velocity. Rumovsky, a student of Euler, writes in a letter (December 7, 1756), that "he (Lomonosov) proves that the quantity of motion is not proportional to the mass multiplied by the square of the velocity." (11). Further evidence that Lomonosov spoke in a quantitative manner may be obtained from the following statement in his dissertation, "Upon Chemical Solvent in General" (1748): "When a body accelerates the motion of another, giving it part of its motion, it does it in such a way as to lose the same amount of motion." (12).

In the time of Lomonosov, one of the most debatable questions was the phenomenon of combustion. The experiments and teachings of Jean Rey (1630), John Mayow (1674) and Robert Boyle, in the end of the 17th century, were presumably known to Lomonosov. His natural curiosity was especially aroused by the experiments of the latter. The *principium inflammabile phlogiston* was in vogue: like ether in the physics of modern times, *phlogiston*, two centuries ago, did a number of marvelous things. According to Boyle (1673) this substance of fire was able to pass through glass, and uniting with metal, to form an oxide. His experiment was simple: Boyle took a glass retort, placed in it lead or tin, and then sealed the neck. The retort and the metal were then weighed; after two hours' heating, the metal formed an oxide. Then Boyle broke the neck of the retort, upon which the air rushed in, and then weighed the retort again. He found a noticeable increase in weight.

Lomonosov repeated this experiment with one modification: after heating he weighed the retort without opening it, and found no increase in weight, from which he inferred (1756) that the "substance of fire" did not pass through the glass. Lomonosov concludes that "by these experiments it was found that the opinion of the eminent Robert Boyle was incorrect." (13).

In the summary of a report made to the Academy (in 1760), he further emphasizes that it "was proven by me . . . that Aristotle's elementary fire, or, according to modern scientists, a special heat-generating substance which passes from one body to another, wandering without the slightest plausible reason, is only fiction. I firmly declare that fire and heat consist of the rotary motion of particles of the matter composing their bodies." (14).

Such were the far-reaching statements of this remarkable man. They all met with more or less disapproval by his colleagues, and among all of them, perhaps Euler alone realized their significance and was the only one to encourage Lomonosov.

Though denouncing Boyle for his theory of oxidation, Lomonosov paid considerable attention to his experiments on the "spring of the air and its effect." Having built a mechanical explanation of heat, it was not difficult for Lomonosov to apply

his theory to the property of gases. His conclusions, which appeared under the title of "An Attempt to Formulate the Theory of the Elastic Power of Air," coincide with our modern theory of gases. One of his inferences is, however, worth noting. On purely theoretical grounds, Lomonosov came to the conclusion that a gas will not obey the Boyle Law at high pressure: the volume occupied by the molecule would become apparent and would involve a correction. This fact was acknowledged 115 years after Lomonosov made his inference, and as we know, satisfactorily shown by Vander-Waals.

Lomonosov was interested in the nature of light quite as much as in the theory of heat. The mechanical model devised by him to account for the properties of light, though ingenious, did not survive the test of time. An account of his theories is given in "A Word About the Origin of Light, Offering a New Theory of Colors" (1756). "Light and heat come from the sun," says Lomonosov, "from which we must conclude that both are produced by the same substance, though by different motions." (15). Dismissing as impossible Newton's corpuscular theory of the propagation of light, he proceeds as follows: "Since ether produces heat (a rotary motion of particles) in terrestrial bodies, it must contain that motion in itself. Ether cannot have a streaming motion, while rotary motion produces heat without light; therefore, there remains only a third possibility: a wave motion of ether, and this must be the cause of light." (15). It is, indeed, a rather fine piece of logic, and perhaps we must give credit to Lomonosov for choosing, from many current hypotheses, the one which proved itself to be of greatest value.

His mechanical scheme of the composition of light is in many ways unsatisfactory to us. According to Lomonosov, the ether is composed of spherical particles. There are three kinds of these, differing in size: the largest packed as close as possible, hold between themselves smaller particles. In the spaces left between the spheres of the smaller are similarly located spherical particles of still smaller size. All of these three sizes of spheres have independent rotary motions.

"Finally I find," writes Lomonosov, "that from the first kind of ether (the largest particles), comes the color red, from the second—yellow, from the third—blue. Other colors arise from the mixture of these three colors." (16) Then, he emphasizes that: ". . . the motion which produces heat and color is a rotary one: the substances (in which the motion is produced in these two cases) differ." (17).

The scheme is a rather complicated one, and was made still more so by further assumption, necessary to account for the transmission of heat and color from the ether to the tangible matter.

We shall not attempt to describe this scheme here, but will pass to the subject of atmospheric electricity in which Lomonosov was interested as well as Benjamin Franklin.

In June 1752, Russians learned of the discoveries of the American scientist. A

member of the Academy of Science, Richmann, undertook to repeat Franklin's experiments, and for this purpose built a suitable device for capturing spheric electricity. Lomonosov also built at his house a very similar "thunder machine." All went well until July 26, 1753. On this day, during a conference at the Academy, Richmann saw the beginning of a thunder-cloud and hurried home. There, according to a witness, he was standing about one foot from the machine, when a blue, fiery ball made its appearance, struck the professor directly on the forehead and he fell dead without a sound.

This sad incident produced a storm in the Academy. Lomonosov wanted to deliver at once an address giving a scientific explanation of atmospheric electricity; other members opposed him, some because of personal antipathy, others on the ground that it was not fitting to hold a scientific meeting so soon after the death of one of their colleagues. Finally, the address was delivered on November 25, 1753. Its chief point of interest lies, perhaps, in Lomonosov's explanation of the origin of atmospheric electricity.

In 1751 and 1752, Lomonosov carried on numerous measurements of the density of air at different temperatures. These studies brought to his mind the supposition that in the atmosphere there exist not only horizontal currents of air, but also vertical ones. In continental countries thunder storms are likely to occur between three and four o'clock in the afternoon, when the hot air near the earth rises to higher regions. Lomonosov writes: "Who will doubt that in the summer, water vapors, being heated by the sun, fly against each other causing friction? . . . It is highly probable that the electrical force in the air originates from the heat and friction of these (water) vapors." (18).

According to Lomonosov, sudden frosts and thunder storms have a very similar origin, the only difference being that in the case of sudden frosts, there is a descending current of cold air. Lomonosov, in support of this theory, calculated the density of air at various temperatures, and thus found conclusive proof that cold air, being heavier, must tend to descend to the surface of the earth.

In many ways, Lomonosov's ideas on meteorology were very like those of Franklin. However, he defends his independent discoveries as follows: "The ascending and descending currents of air were briefly mentioned by the illustrious Mr. Franklin in his letters. However, I do not owe him anything, since I first thought and spoke about descending currents of air several years ago, and saw Franklin's letters for the first time when my speech was already written, to which fact my colleagues will bear witness. Secondly, the descending currents of air were mentioned by Franklin in a few words as a guess. I deduced my theory from sudden severe frosts, phenomena unknown in Philadelphia where Franklin lives. . . . I do not add all this here because I wish to outshine (Mr. Franklin), but because of the wishes of my colleagues, who advise me to annex this for my justification." (19).

An Experiment in Electro-Physiology.

This experiment is described by Lomonosov as follows: "On the third of last August, when the sun was setting, I connected an American sensitive plant (*Mimosa pudica*) to an electrical machine. Its leaves were already closed, and after repeated touching by the hand, they contracted so much that upon further touching there was no more reaction. When the electrical machine was put into action, so that sparks jumped to one's finger, then the leaves, already much contracted, reacted again when touched and contracted still further. After repeating this experiment many times, I was convinced, with pleasant surprise, that the sensitive (plant) is revived by the stimulus of electric force and that its sensitivity has some relationship to it." (20).

Contribution to Astronomy.

The Newtonian reflectors were known to Russians of Lomonosov's time. A concave paraboloid of glass, silvered on its curved surface, forms the objective of these reflecting telescopes. Newton placed a small mirror on the axis, which reflected the rays out through the side of the telescope, and the image was then seen through an eye-piece.

This second mirror had one drawback: it obstructed some of the incident light, and Lomonosov conceived a rather simple idea. He inclined the paraboloid mirror a few degrees, so that the image fell at the side of the body of the telescope. This modification of Newton's reflector described in Latin by Lomonosov's "A Speech on the Improvements of Telescopes" (1762), (21) is usually credited to Herschel (1789).

The night of May 26, 1761, was anxiously awaited by astronomers of Europe and Russia. On this date was due a rare phenomenon, which will not occur again until 2004: the passage of the planet Venus over the disk of the sun. The Academy, besides making preparations to observe the phenomenon in St. Petersburg, sent two expeditions to Siberia.

Lomonosov observed this event from his house. He and other scientists in a joint report to the Academy, expressed their observations as follows: ". . . the Councillor Lomonosov states that the planet Venus is surrounded by considerable atmosphere, similar (perhaps even greater) to that which surrounds our earthly globe. This is so, because, firstly: before the entrance of Venus over the surface of the sun, there was a loss of visibility of that side of the sun. . . . When Venus was leaving (the sun), the contact of its front edge produced a prominence. This could only indicate a refraction of the sun's rays in the atmosphere of Venus."(22).

The observation was correct.

Contribution to Geology and Mineralogy.

Though the science of minerals may be called one of the oldest in Europe, before the time of Lomonosov Russians had only a scattered knowledge of this useful art. As we remember, Lomonosov went to Germany primarily for the purpose of studying

mineralogy and assaying, although upon his return to Russia, he applied himself mostly to sciences having a greater theoretical significance.

His chief contribution was perhaps the fact that he transported bodily to Russia the contemporary knowledge of geology, mineralogy, as well as metallurgy. Beside this passive role, his restless mind could not avoid being drawn into the mystery of the origin of the metals of our earth's crust. His contribution to these subjects may be found in his essay, *A Word About the Birth of Metals from the Movement of the Earth.* (1757), and his book, *First Elements of Metallurgy and the Knowledge of Ores,* with two supplements: *About the Free Movement of Air in Mines* and *About the Strata of the Earth* (1763).

The plan of the *Strata of the Earth* is remarkably modern: Chapter I. contains "The Form and Relief of the Earth"; Chapter II, "Rocks and the Form in Which They Exist in Nature"; Chapter III, "Changes of the Earth's Surface Due to Wind, Water and Ice"; Chapter IV, "Changes Which Are Connected with the Shaking of the Earth, *i.e.,* The slow prolonged rise and fall of the earth's crust"; Chapter V contains the concluding part.

The expression "shaking of the earth" is especially interesting. Lomonosov includes in this definition not only earthquakes proper, but also the prolonged rise and fall of the earth's surface and the formation of mountains.

The tectonic and volcanic processes have one origin, according to him. Their cause is the changes occurring inside the earth. The mountains are made of strata formed in the sea, as they contain shells by various mollusks. These strata, necessarily, were first horizontal, but rose to various heights. According to Lomonosov, the continents are surrounded by the sea, but not the sea by continents. He writes: "In some places the shores, due to the receding of the sea, increase so much that some scientists question where the water is distributed. . . The question is futile because, due to changes in the earth's crust, its surface may rise in one place and be depressed in another without changing the level of the water. Doesn't nature suggest by the powers confined in the heart of the earth, the forces upon which depend the rise and fall of its surface? Doesn't she proclaim that a plane upon which people travel, dwell, build villages and towns, was long ago the floor of the ocean, though now it lies far from it . . . even as much as 300 *versts?*" (23).

The movements of the earth are the cause of the ore-bearing veins. Solutions of metals run through the cracks of the earth, forming veins. "All these veins are produced by the shaking of the earth." (24).

In the essay on the origin of metals, Lomonosov writes: "In the second place stand the fatty substances found in the earth, such as slate, coal, asphalt, rock-oil and amber. It is evident that all of these as well as other substances related to them, were produced by disintegration. Thus, slate is nothing more than mould, formed from decayed herbs and leaves, washed from fertile ground and forests, which in the

old days settled on the bottom of the lakes like slime. The lakes dried and filled up with sand, and the slime solidified in time into slate. . . . As for amber, one wonders how some learned people, great in name and service, can consider it a mineral. They do not take into account the large number of animals, not to mention the multitudes of leaves, imprisoned in it; all these oppose this explanation, seeking to proclaim aloud that they were caught by the liquid resin that was shed by the trees, surrounded by it and left imprisoned." (25).

This is probably one of the finest pieces of Lomonosov's thinking; it witnesses again his strong desire to let objects tell their own origin, rather than to assign one to them. It is typical of him.

Such are the contributions of Lomonosov in the field of natural science. If we take into account his contributions to poetry and philology, which are no less significant than his contribution to science, we may, without hesitation, agree with Pushkin that Lomonosov was a university in himself.

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For the sake of clearness, words and sentences in brackets have been introduced by the writer in the quotations from Lomonosov.

For the transliteration of Russian words, we have adopted the system commonly used in England and in this country. It differs from that adopted by a group of editors in England (*Nature,* February 27, 1890); we have transcribed the fourth letter of the Russian alphabet by "g," they by "gh"; the twenty-third by "ts," they by "tz"; the twenty-eighth by "y" in place of "ui." The short Russian "i" is transcribed here also by "y."

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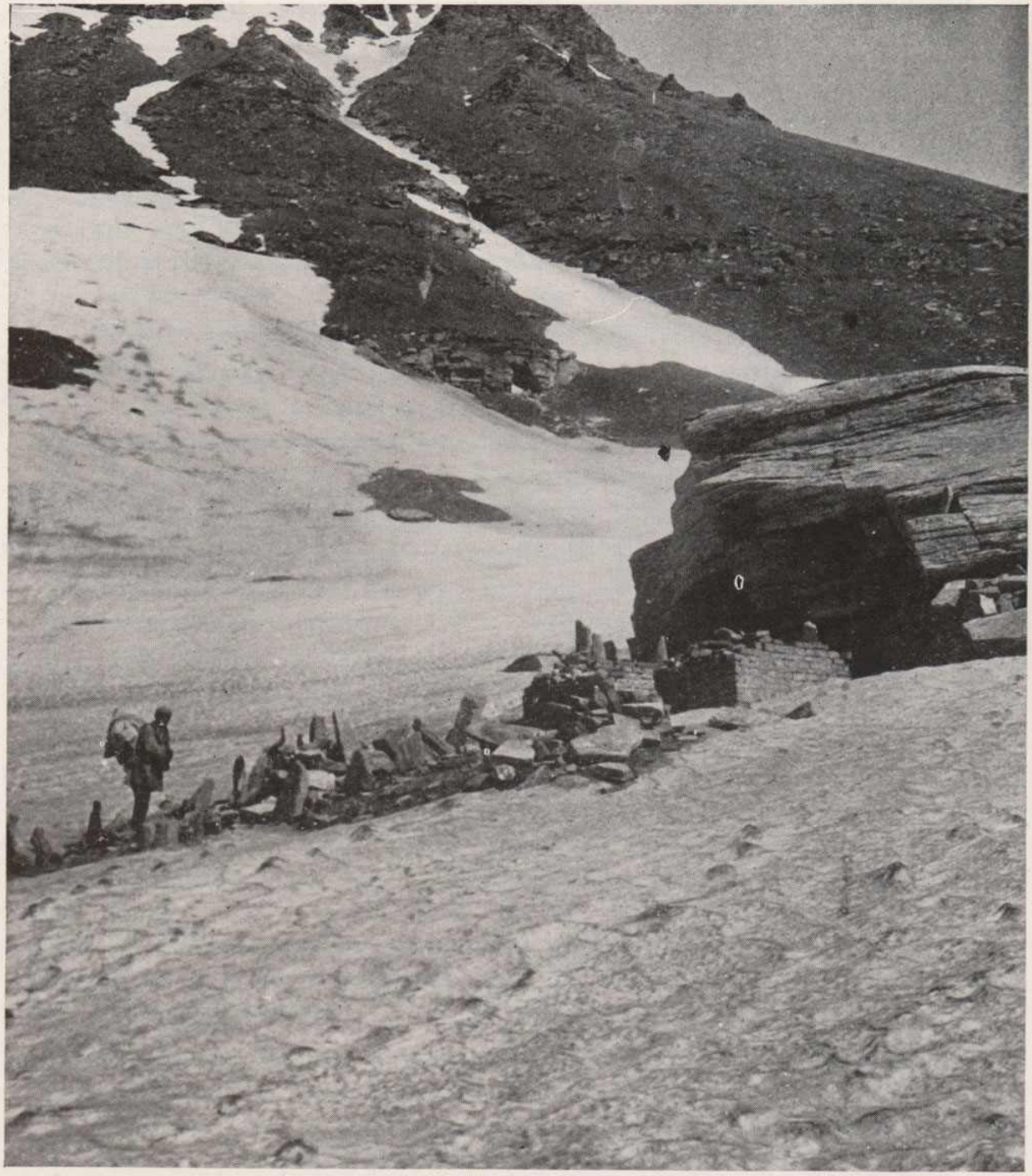


ROTHANG PASS. 13,500 FEET.

ANNUAL REPORT
of
URUSVATI
HIMALAYAN RESEARCH INSTITUTE OF ROERICH MUSEUM
1929 - 1930

FOUNDED on July 12th, 1928, the Himalayan Research Institute reached in 1929-1930 its first creative year of research activity. The beginning of this year was necessarily taken up by organization work and preparations for the field programme of the summer of 1930. The fundamental aims of the Institute were outlined by the writer of the present Report in two pamphlets, which were printed by order of the Trustees of the Roerich Museum.

The Institute is an immediate outcome of the Roerich Central Asiatic Expedition, which toured under the leadership of Professor N. de Roerich the countries of the Middle East. The Founders of the Institute realized the urgent necessity of building up a permanent institution for the scientific study of this most interesting region of Asia. With the growing demand for specialization, it has become impossible for one man to cover the whole ground and to face all the innumerable problems which present themselves to the explorer. A new type of expedition organization answering the requirements of modern research has long been a necessity. This new type of expedition tends to enlist a group of specialists, each in charge of his own field of research; moreover, it tends to develop into a moving research station—that is, bodies of scientists spending considerable time in one region, and establishing research bases at various points within the region. This new type of expedition facilitates the accumulation of exact data on the country and provides the scientific workers with a unique opportunity to test and verify their results. It is to encourage and carry out this new aspect of scientific research in Asia, that the Roerich Museum founded the Himalayan Research Institute, which proposes to conduct original scientific research in the countries of the Middle East that still remain an unexplored field for scientists.

The study of the Middle East is the Institute's primary aim, but we can safely add that "the bounds of its investigation will be the geographical limits of Asia, and within these limits its inquiries will be extended to whatever is performed by Man and produced by Nature," the significant words pronounced by Sir William Jones in founding the Asiatic Society of Bengal in 1784. Under the term "Middle East" we understand India and the whole of that desert and mountainous part of Asia stretching from the plateau of Irān in the West to the borders of China proper in the East, and including Chinese and Russian Turkestān, Mongolia and Tibet. Of course, much of this vast territory is now closed for scientific work, but it is

hoped that a more enlightened period may soon dawn on the Heart of Asia, bringing with it a new possibility for scientific research.

The present headquarters of the Institute are situated on land donated for this purpose by Professor Nicholas de Roerich, at Naggar in the Kulu Valley, Western Himālayas.

The Institute is supported by an annual grant from the Roerich Museum, New York, and by voluntary donations.

The Himalayan Research Institute includes the following departments:

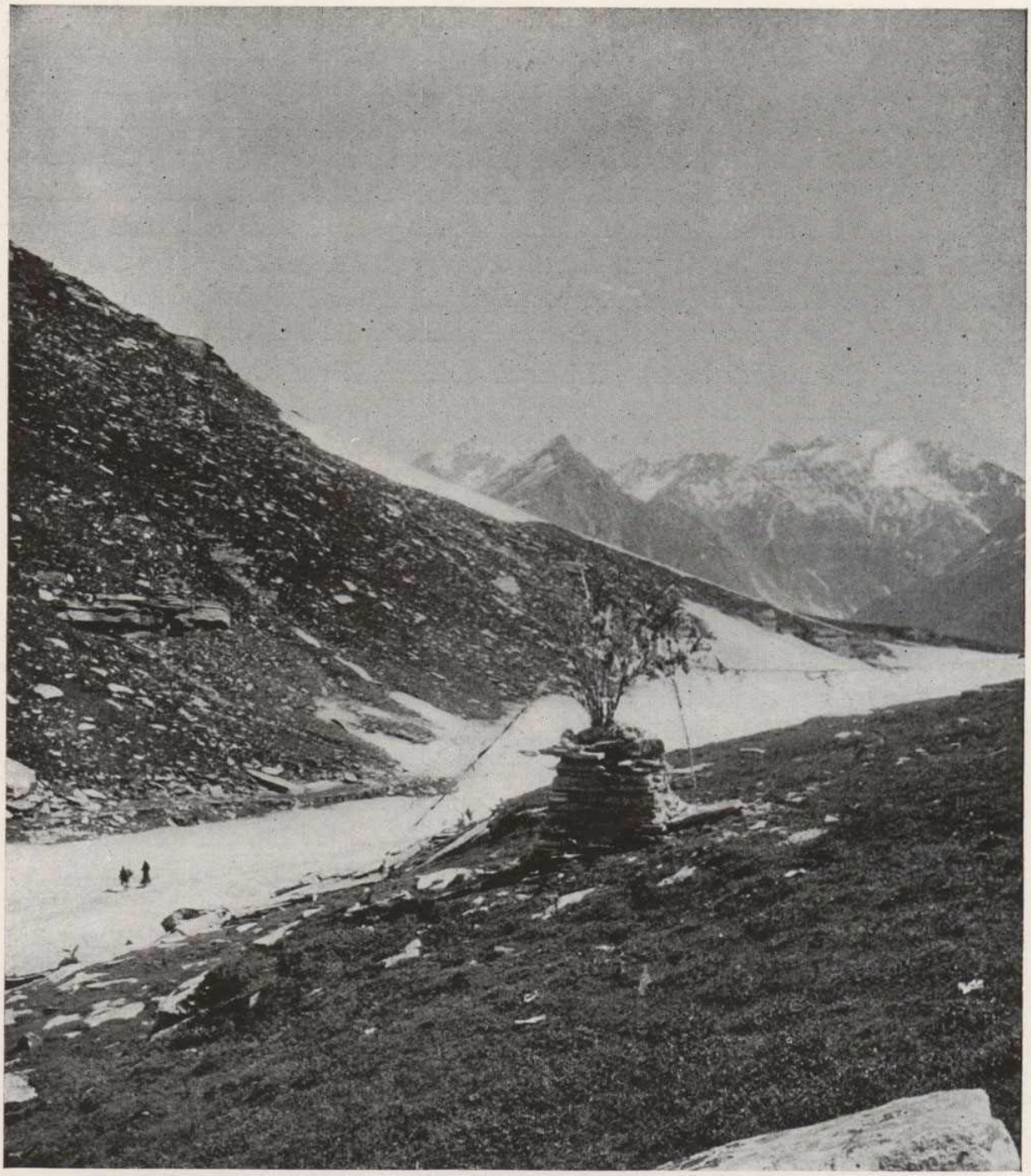
A. Dept. of Archaeology, related sciences and arts.
B. Dept. of Natural Sciences and applied research.
C. Research Library.
D. Museum to house the collections of the Institute. We shall record here the different activities of the Institute according to the various departments.

Department of Archaeology, Related Sciences and Arts.

During the winter months of 1929-30 the Director conducted a series of lectures in the United States on the Roerich Central Asiatic Expedition, Tibet and Mongolia. During this period active steps were taken to organize the activities of the Institute. Simultaneously with the fortieth anniversary of Professor de Roerich's activities in the field of art and culture, on the 17th of October, there was opened, in collaboration with the International Art Center of the Roerich Museum, an exhibition of the Tibetan collection brought back by the Roerich Central Asiatic Expedition. A descriptive catalogue of the exhibition was issued, with a preface by Dr. Christian Brinton, and an Introduction by the Director. The exhibition was on display throughout November and December, and several talks on Tibetan art were delivered by the Director.

A significant development was achieved when the Archaeological Institute of America, represented by its President, Dr. Ralph V. D. Magoffin, and the Himalayan Research Institute agreed to mutually support their undertakings in the field of archaeology in the region of the Middle East. Professor de Roerich was elected Vice-President of the Archaeological Institute, and Dr. Magoffin, an Honorary Advisor of the Roerich Museum (Division of Science). Valuable contacts were made with the School of American Archaeology, whose Director, Dr. Edgar Hewett, is a Vice-President of the Himalayan Research Institute and Honorary Advisor of the Roerich Museum. It is hoped that scientific cooperation between the newly established School of Pacific Research and our Institute will open new avenues of scientific research.

On the twenty-ninth of March, a farewell reception was arranged, and addresses were delivered by Professor Nicholas de Roerich, Dr. R. V. D. Magoffin and Miss Frances R. Grant. After the speeches a film, "Silver Valley," was shown



STONE-CAIRN ON ROTHANG PASS.

to the audience. This film was taken by Mr. S. N. Roerich during his sojourn in Kulu in 1929.

On April 4th, Professor de Roerich, President-Founder of the Institute, and the Director left for Europe to negotiate with the proper authorities regarding the various possibilities for scientific exploration. Unfortunately the negotiations with the British Government took much more time than was originally anticipated, and thus considerably curtailed the activities of this Department for the year. During these negotiations the Staff of the Institute received full support from the various Foreign Branches and Representatives of the Roerich Museum who intervened on the Institute's behalf and enlisted the cordial support of their respective governments. It is our pleasant duty to express to them all the Institute's sincerest appreciation of their unselfish efforts. A complete and detailed report of these negotiations is now in the hands of the Board of Trustees of the Roerich Museum.

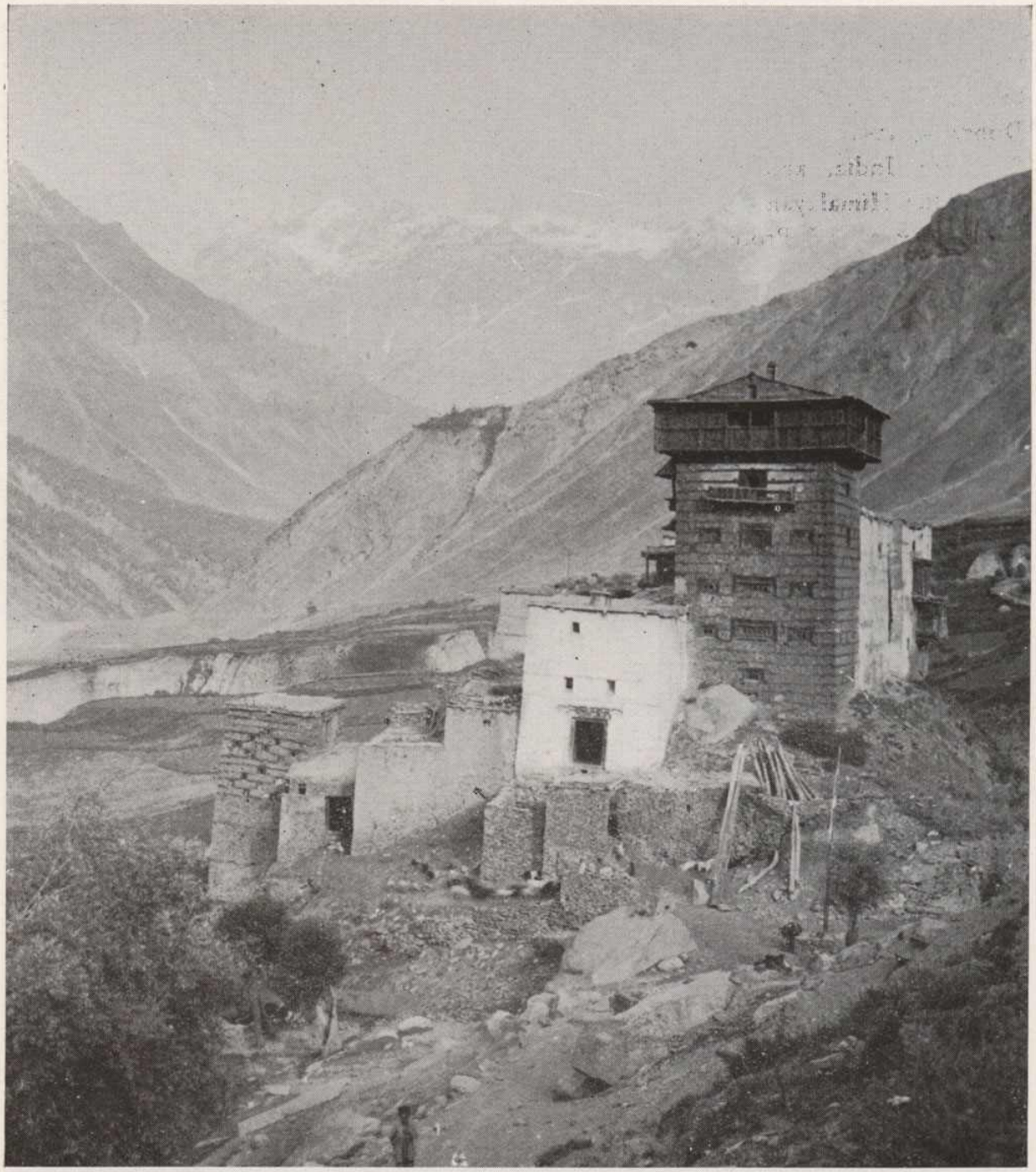
During this stay in Europe, Professor de Roerich and the Director received full support from the Government of France and French Scientific Institutions, with which numerous and important contacts were made. This enlightened attitude of the French Government and Scientific circles will, no doubt, result in fruitful cooperation between them and the Institute. Plans are being discussed to foster and cement this cooperation.

During their stay in Paris, Professor de Roerich and the Director, accompanied by Dr. Georges G. Chklaver, European Secretary of the Roerich Museum and Secretary-General of the French Roerich Society, had the great honor to be received in audience by His Excellency, the President of the Republic. During this significant interview, Professor de Roerich had the occasion to outline to His Excellency the President, the programme of the Institute's scientific activities in the East. His Excellency graciously expressed his interest in the scientific work of the Institute and assured Professor de Roerich of his good will. Interviews were also arranged with H. E. Monsieur Marraud, Minister of Public Instruction, and H. E. Monsieur Pietri, Minister of Colonies, with the view of establishing cooperation with the French Colonial Scientific Institutions. H. E. the Minister of the Colonies expressed his full approval of the proposed scientific exploration and suggested the possibility of extending the research of the Himalayan Research Institute into French Indo-China and adjacent regions.

Professor de Roerich has been elected Honorary Member of the Yugo-Slavian Academy of Arts and Sciences. The Academy expressed its willingness to cooperate with the Institutions of the Roerich Museum.

Professor de Roerich has also been made Honorary President of the Institute of Higher Oriental Studies, whose President is Baron M. A. de Taube, Fellow of the Institute of International Law.

On the eleventh of October, Professor de Roerich, accompanied by Dr.



THAKUR'S PALACE AT GUNDLA, LAHUL.

Georges de Roerich and Dr. C. C. Lozina, Medical Advisor of the Himalayan Research Institute, left for French India, where they arrived on the fourth of November. The Ministry of Colonies and the Ministry of Public Instruction had previously informed the Governor of French India of their arrival in order to facilitate the stay of the Institute's representatives in the Colony. During this visit to Pondicherry enthusiastic support was received from Professor G. Jouveau-Dubreuil, author of many remarkable works on the history and archaeology of Southern India, and the Rev. Faucheux, a noted archaeologist; both scholars joined the Himalayan Research Institute in the capacity of corresponding members. The Director and Professor Jouveau-Dubreuil outlined plans for an archaeological exploration of South Indian prehistoric sites. Rev. Faucheux very kindly assisted and guided the Institute's representatives in the exploration of several prehistoric burial grounds and urn-fields found in the environs of Pondicherry. The rich urn-fields of the vicinity of Pondicherry were carefully and scientifically explored by the Rev. Faucheux and Colonel Lafitte, of the French Medical Service in Pondicherry. Several thousand urns and clay sarcophagi were excavated, and the rich collection of iron implements, pottery and important human skeletal remains has now been sent to Paris for a careful study by specialists. The priority of publication belongs to Colonel Lafitte and the Rev. Faucheux, and we therefore give here only a brief account of the executed explorations.

The first site to be examined was that of Pakkamodiampeth on the Madras Road, some six miles from Pondicherry. This site represents a plateau of argilliferous sandstone cut by several small canyons, due to the frequent flooding of the site and heavy rains. The water drains have uncovered numerous urns, showing that the site must have been an urn-field. The finds consist of pottery, crude stone celts. hammer stones, hand-axes and flints with traces of chipping. Most of the stone implements were found at the bottom of water drains, having been carried down from the higher levels on which the urn-field was situated. The site was carefully explored by Rev. Faucheux, who possesses a good collection of stone implements and pottery.

The next exploration was made in a large urn-field situated about eight miles from Pondicherry, on the road to the Grand Etang. This important urn-field, which contains both urn burials and clay sarcophagi, was carefully excavated by Colonel Lafitte and Rev. Faucheux. During Professor de Roerich's and the Director's stay in Pondicherry, a visit was paid to this important site and an untouched urn burial was excavated. The excavation yielded several well-preserved specimens of earthenware, fragments of daggers and the well-preserved iron blade of a sword, placed outside the urn. Besides the above mentioned finds, the examination of the argilliferous sand found in the urn revealed fragments of a human skull, well-preserved molar teeth, and fragments of femur.

LAMA DANCES AT GUNDLA, LAHUL

The whole excavation was carefully recorded and the finds are now preserved in the Museum at the Institute's Headquarters in Kulu. Besides this excavation, a sarcophagus was opened, and this last excavation yielded some fragments of pottery and a flat iron celt, placed outside the sarcophagus. Analogous urn-fields and clay sarcophagi have been discovered in various places in North and South Arcot. It is as yet difficult to assign a date to these Pondicherry finds. The local Hindu population continued to bury their dead until a comparatively recent period, but the character of the Pondicherry urn-fields and the presence of stone implements make it highly possible to assign these sites to an earlier period. The study of Colonel Lafitte's collection will no doubt remove the present difficulty of assigning a date. The Director has to thank the Rev. Faucheux for his kind permission to examine his collection and his rich photographic material of the excavations.

On the 11th of December, Professor de Roerich, Dr. Lozina and the Director reached Naggar, Kulu. During the Director's absence, Mme. Helena de Roerich, Honorary President-Founder, and Miss E. J. Lichtmann, Member of the Board of Trustees of the Roerich Museum, had very kindly supervised the administrative activities of the Institute. A severe illness unfortunately prevented Mme. de Roerich from taking a more active part in the work. We take this opportunity to express to them both our sincere appreciation.

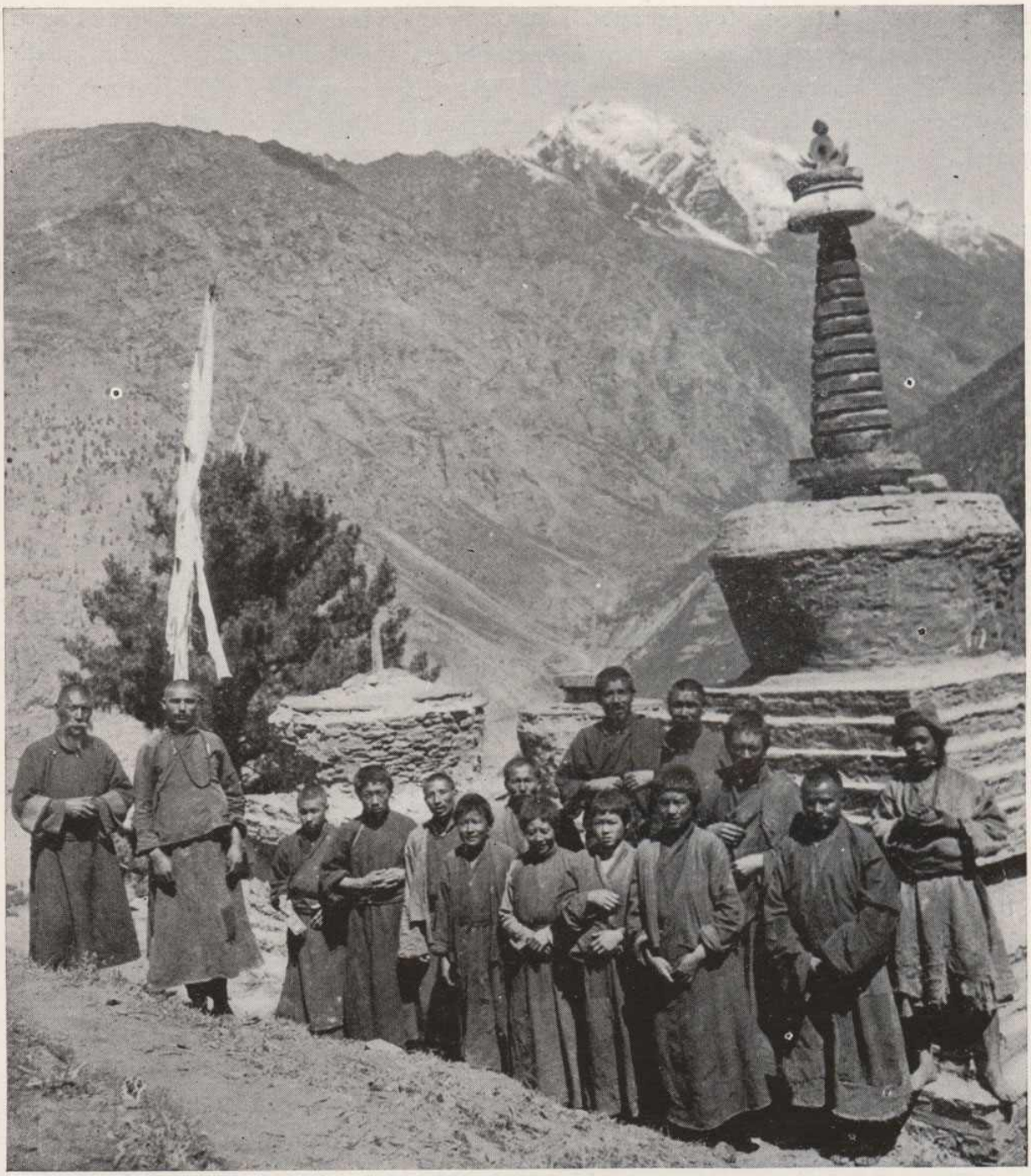
In December 1930, Col. A. E. Mahon, D.S.O., joined the Staff of the Institute.

Department of Natural Sciences and Applied Research

The Head of the Biological and Botanical Section of this Department, Dr. Walter Norman Koelz of the University of Michigan, arrived at the Headquarters on the 28th day of May, 1930, and at once proceeded with the botanical exploration of the alpine flora of the Kulu Valley. On July 10th, Dr. W. Koelz left for Lahul across the Rothang Pass. His explorations are described in the following brief report:

"In the middle of July collecting was begun across the Rothang Pass in Lahul District and this work has proceeded through the summer. The Lahul District has been covered from Jupa on the one side to and across the Chamba border, and to the Rothang Pass. Explorations have been made not only in the river bottoms but also on the slopes up to the perpetual snows. The botanical collection now comprises some 10,000 numbers, representing over 1300 specimens. It is believed that 90% of the Lahul flora is included in this collection. Range extension of known species will undoubtedly be revealed by analysis of this material and it is probable that new forms will be discovered.

"The specimens form a basis for the study of the ethnobotany of the region. Wherever possible, information has been gathered regarding native uses of plants and a surprisingly large percentage is used as food, flavoring, medicine and ornament. Particular stress has been given to the acquisition not only of an herbarium



LAMAS AND NUNS AT KYELANG, LAHUL

of the medicinal plants (these are known only by Tibetan names) but also specimens of as many as possible have been gathered so that they will be available for future experimental uses. Information about the medicinal herbs is in the possession for the most part of a few initiated lamas. Every effort has been made and with considerable success, to secure their cooperation in the study of the Tibetan medicines. Their naming of the plants is of course indispensable. The various men have been separately consulted and the information from the several sources compared.

"In addition to the plant collections, a good collection comprising at present some 300 specimens, has been made of the local birds. This number, it is expected, will be raised to 1000 during the year. It will contain many rare specimens and some completely new. Minor collections have also been made of the mammals, reptiles and insects. It will be possible to distribute to foreign institutions at least three complete sets of herbarium material. There will also be a number of incompicte sets available for gift or exchange, besides many specimens of zoological material. It should also be mentioned that seeds of interesting alpine plants will be sent to interested collectors abroad, among them seeds of some species that will certainly be found to be valuable additions to the flowers now cultivated.

"In view of the fact that the study of the medicinal uses of the plants is so important a part of our work, it is suggested that next year collections be made in Spiti and Ladāk.

"The study of the plants from the various aspects: plant ecology, phytogeography, ethnobotany, affords a field of tremendous possibilities. It is much to be hoped not only that the present studies can be continued, but that their scope can be expanded."

The following botanical collections have been forwarded:

1. To the University Herbarium, University of Michigan, about 3000 numbers, representing about 1500 specimens. Also an entomological collection.
2. To the New York Botanical Garden, New York, about 3000 plants, representing about 1500 specimens. Also a collection of seeds.
3. To the National Museum of Natural History, Paris, about 2000 plants, representing about 1200 varieties. Also a collection of seeds.
4. To the Bureau of Foreign Seed and Plant Introduction, Department of Agriculture, Washington, D. C., a collection of seeds.

Dr. E. D. Merrill, Director-in-Chief of the New York Botanical Garden, very kindly agreed to supervise personally the identification of the plants of the collection.

The collection donated to the University Herbarium, University of Michigan, will be identified by Professor H. H. Bartlett.

A complete herbarium of the local flora has been set up at the Headquarters.

On his return from Lahul on October 1st, Dr. Koelz continued his exploration

DR. W. KOELZ WITH HIMALAYAN BEARDED VULTURE AT LAHUL, ALTITUDE 11,000 FEET.

of the 8,000-12,000 foot altitudes in the Kulu Valley, and on the 5th of November left for an extensive trip to Rampur Bashahr and the Upper Sutlej Valley, from which he returned to the Headquarters on the 31st of December.

Dr. W. Koelz's report on the biological survey of the Sutlej Valley in Rampur Bashahr is given in the following:

"The biological and botanical collector was absent from November 5th to December 31st, on an expedition to Rampur Bashahr. The expedition had as its object to survey the Sutlej Valley for future biological collecting and to secure specimens of certain big game animals of which a relatively large number of species occur in this province. Rampur Bashahr borders the districts of Kulu and Spiti on the one side and Tibet and Garhwal on the other, and opens onto the Punjab plains. It was to be expected therefore, that the flora and fauna would show interesting features. The expedition proceeded up the Sutlej from the city of Rampur to within a day's march of the Tibetan Pass, stopping to make collections at alternate stages: Sarahan, Taranda, Urni, Pangi, Kanam and Poo. At Lipe, Shasu and Ropak extensive collections were made. On the return from Sarahan another route was followed that led across the Darughat Pass and opened onto the Sutlej below Rampur. Stops were made for collecting at Darughat, Joggri, Darkali and Noggri. The province shows most interesting and varied habitats. From the semi-arid lower stretches of less than 5,000 feet elevation one may proceed consecutively through the yellow pine, fir, holly-oak and neoza forests to the treeless plateau that adjoins Tibet. At this season most of the plants are dormant, but a few shrubs and trees below 8,000 feet elevation have the habit of blooming before the snow falls. Two species are particularly noteworthy because of their attractiveness: a cherry tree that grows to 30 feet in height and a densely shrubby Viburnum that grows to a height of 20 feet. Both are pink, the latter fragrant, and are so free-flowering that they arrest attention from afar.

"The valley is famous for the neoza, a little pine nut, indistinguishable in flavor or appearance from the American piñon, that grows in the upper stretches; it is gathered by the maund (82 lbs.) and carried on cowback for 100 miles to Rampur and thence sent to the Indian cities. The nuts are laboriously gathered by hand. It should also be mentioned that the apricot grows particularly well throughout the valley, but becomes progressively sweeter as the elevation increases. Above Jangi the fruit is so sweet that it can be eaten when dried, without sugar, and in the area above this point the dried fruit is an important article of food. The seeds of some sweet varieties are also edible. Apples and pears that have been planted in this upper area are of superior sweetness and flavor.

"Rampur Bashahr is rich in animal life. Particular attention was paid to the birds, and over 300 specimens, representing some 60 species new to the Institute's collections, were secured. Many species that range to the east reach their westward

RHODODENDRON FOREST IN LAHUL.

limit here and the study of the collection will undoubtedly show an extension of the known ranges of some species. There is also a variation in some species as the valley ascends and this field is especially fruitful for investigation.

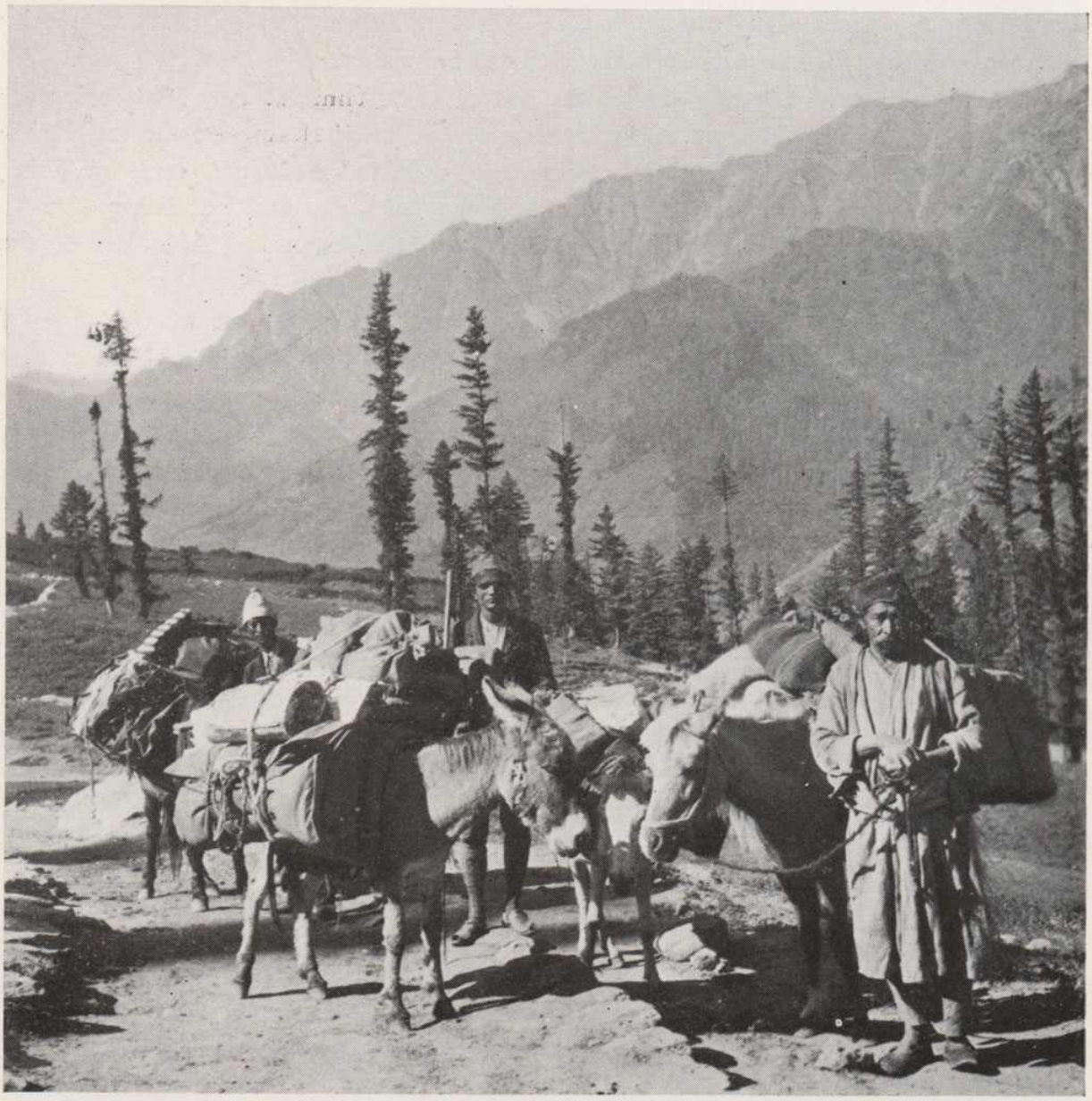
"One of the main purposes of the expedition was to secure specimens of the napo, a curious Tibetan goat that enters India in this region. In addition to the napo (*Ovis nahur*), specimens of ibex, the huge mountain goat with immense horns over three feet long, the black and red bear, and the gorral were also obtained, making a total of eight big game, as well as a number of small fur-bearers: fox, marten, coyote, etc.

"There is also abundant material for the ethnographer in the valley. Here Hindu and Tibetan peoples have met and the product is a culture that is peculiar to the district. Languages, folklore and customs vary not only in this valley, but are unlike the languages and lore of adjoining valleys where, too, the Hindu and Tibetan have mixed. Six dialects are spoken from Rampur to Poo, the outpost of the Tibetan language. They are roughly grouped as follows: (1) lower valley and Sarahan, (2) above Sarahan to Taranda, (3) above Taranda to Kanam, (4) above Kanam to Ropak, (5) above Ropak to Poo, (6) the dialect of the blacksmiths.

"It is strongly recommended that further research should be continued in the Upper Sutlej Valley. The results will not only be extraordinarily rich and interesting in themselves, but will also supplement by comparison and contrast the findings in the adjoining districts in which intensive researches are already under way."

The above extensive explorations of Dr. W. Koelz were assisted through the munificence of Mrs. Henry Ittleson, Chairman of the Patrons' Committee of the Institute, Miss Theodora Palmer, Miss Virginia Palmer, Mrs. Laurette Schinasi and Mrs. Franklin S. Terry. To all these friends of the Institute, we extend here our sincerest gratitude. In the summer of 1931 Dr. Koelz plans an extensive expedition for botanical and zoological research in Ladāk; permission for such an expedition has been received from the authorities. The purpose of this new expedition will be to investigate the flora and fauna of Western Tibet and its plateaus of high altitude.

During his stay in New York (winter, 1929-30) the Director had interviews with prominent scientists and scientific institutions in the United States, with the view of fostering and developing the activities of this Department. Mr. V. A. Pertzoff, M. A., Corresponding Member of the Himalayan Research Institute, and the Director outlined detailed plans for the erection and equipment of the Biochemical Laboratory at the Headquarters in Kulu. This Laboratory will be the center of the medical research of the Institute. It is the Institute's aim to record and study the rapidly vanishing medical knowledge of the local medicine men, and to experiment on medical herbs, for which purpose the Kulu Valley affords special possibilities. Particular attention will be paid to Tibetan pharmacopoeia



DR. KOELZ'S CARAVAN ON THE MARCH. LAHUL.

and it is planned to publish translations with adequate commentaries from Tibetan medical works. At present this department of the Institute's work is in charge of Dr. C. C. Lozina, Medical Advisor to the Institute. An extensive collection of medical herbs was gathered by Dr. Koelz in Lahul and is now being studied and enlarged upon by Dr. Lozina, with the help of native medicine men. All the information collected is carefully catalogued and it is hoped thus to establish a complete inventorium of the local pharmacological knowledge.

Michigan University has offered the use of their clinic at Ann Arbor for experimentation and application of the results of the medical research at the Headquarters of the Institute in Kulu. Extracts from collected medicinal plants are being prepared by Mr. V. Shibayeff, Secretary of the Institute, and are being sent to Dr. Felix Lukin and V. A. Pertzoff, M. A., both Corresponding Members of the Himalayan Research Institute, for experimentation.

The great humanitarian possibilities and momentous interest of this line of research of the Institute are clearly evident to anyone who had the chance of surveying the vast and virgin field presented by the Himalayan highlands. The Institute plans also to undertake research in the field of cancer, for we have reason to believe that new, potent cures can be found in this vast and unexplored domain. It is of utmost importance to begin building the Bio-chemical Laboratory of the Institute, and the Institute's staff will spare no efforts to bring this project nearer to realization.

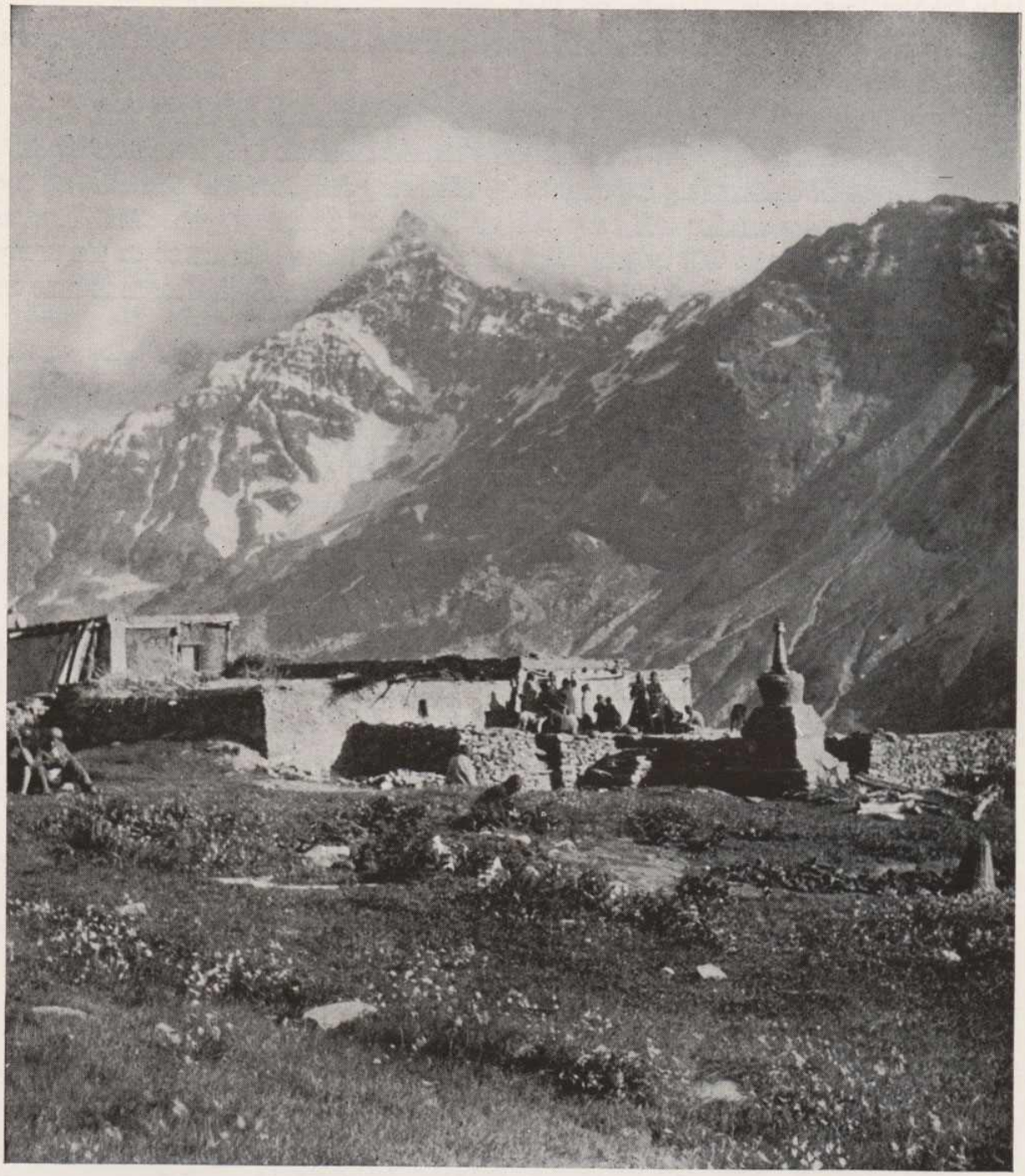
Research Library.

From the very beginning great attention was paid to the Library of the Institute, for it was felt of primary importance to equip the Institute with an extensive Research Library. The Library collects books, pamphlets and manuscripts in the various fields of art and science and will in the future issue monthly lists of Indian and Western scientific publications. It is expected to build up the Library through grants of books and book exchanges with leading scientific institutions and publishers.

During the period 1929-30 the Library of the Institute received grants of books from the following: Carnegie Institution, Washington, D. C.; Professor Nicholas de Roerich; Dr. Felix Lukin; Dr. W. N. Boldyreff, Director of the Pavlov Institute of the Battle Creek Sanitarium, Michigan: the Rockefeller Foundation (through Dr. Homer Swift); Commandant C. J. Cauvet; Prof. H. H. Bartlett, University of Michigan and Dr. Georges de Roerich.

During the past period the Institute established an exchange of publications with the following institutions:

In the United States: Carnegie Institution, Washington, D. C.; Smithsonian Institution, Washington, D. C.; Harvard University; Yale University; Iowa University; Michigan University; Pittsburgh University; Indiana University; Minnesota University;



LAHUL.

Oregon University; Field Museum of Natural History, Chicago; Chicago Oriental Institute; the Metropolitan Museum of Arts; the American Geographical Society; the Nature Association, Washington, D. C.

In Europe: Le Musée d'Histoire Naturelle, Paris; the School of Oriental Studies, London.

The Institute publishes a yearly JOURNAL of its activities in which each department has its section. In addition to the JOURNAL the Institute will, from time to time, publish works of outstanding importance by Honorary Advisors and Members of the Institute. Lengthy articles will be published as separate monographs. The Tibetan studies of the Institute will be embodied in a series *Tibetica*, dedicated to the study of Tibetan antiquity and related subjects. The first volume of this series is now in preparation.

In view of the great interest aroused by archaeological explorations and the importance of scientific methods in carrying out excavations, the Institute decided to publish in its JOURNAL a series of articles on archaeological methods, written by eminent specialists. It is hoped to bring out a manual of archaeological excavations treating the different aspects of archaeology in the countries of the East. The first number of the JOURNAL contains articles by Dr. Ralph Magoffin, President of the Archaeological Institute of America, and Count du Mesnil du Buisson on archaeological methods applied in his excavations in Syria.

During his stay in New York, the Director reconstructed a Tibetan Library and placed in it the complete collection of the Narthang *Känjür* and *Tänjür*, brought back by the Roerich Central Asiatic Expedition. This is the first Tibetan Library to be reconstructed outside Tibet and is now on view in the Hall of the East, at Roerich Museum. The Tibetan collection on display forms a part of the Institute's Library.

The following publications were prepared and issued in connection with the Institute:

M. M. Lichtmann: "Nicholas Roerich and Science" (Article in *Art and Archaeology*, Washington, May 1930).

G. de Roerich: "Les Seize Arhats, Protecteurs de la Loi," *Revue des Arts Asiatiques*, Paris, May 1930.

G. de Roerich: *Trails to Inmost Asia* (a detailed account of the Roerich Central Asiatic Expedition) to be published by the Yale University Press, U. S. A. A French translation is being prepared by Mme. de Vaux-Phalipau, President of the French Roerich Society and Member of the Ethnographic Society of Paris, and will be published in the course of 1931.

G. de Roerich: *Animal Style Among the Nomad Tribes of North Tibet*, Seminarium Kondakovianum, Prague, 1931.

G. de Roerich: "Modern Tibetan Phonology," *Journal of the Asiatic Society of Bengal,* Calcutta, (in print).

G. de Roerich: "Tibetan Tonames," *Sir George Grierson Commemorative Volume,* published by the Indian Linguistic Society, Lahore (in print).

In preparation:

G. de Roerich: *Comparative Grammar of Colloquial Tibetan.* This volume will be published as Volume I of the series *Tibetica,* dedicated to the studies of Tibetan antiquity and related subjects.

Museum.

Mr. V. A. Shibayeff, Secretary of the Institute, has been very active in furnishing the Museum with appropriate glass cases and herbariums. At present the Museum at Naggar is well-equipped with the necessary furniture, and houses the large ornithological collection gathered by Dr. W. Koelz during his trips to Lahul, Kulu Valley, and the Sutlej Valley; the herbarium; and a collection of medicinal plants. Geological and archaeological collections have also been started. All the above collections are being enlarged continuously.

We have to acknowledge with thanks the gift of a projecting lantern and screen—the gift of Mrs. Horch, Miss Lichtmann and Mr. Shibayeff; also a glass case, the gift of Mr. Shibayeff.

In New York the collection of the Institute's Museum was enriched by the Roerich Central Asiatic Expedition's collection of Tibetan banners and sculpture; also by an entomological collection and a mineralogical collection.

A collection of thirty-six lantern slides on Kulu and on the activities of the Institute has been prepared and presented by Mr. Shibayeff to the New York offices of the Institute.

A representative collection of Himalayan flora and fauna will be exhibited in the New York premises of the Institute. It is hoped that this project will be realized in the course of the next year.

Activities in New York.

The activities in New York, since the Director's departure, have been supervised by Mr. Louis L. Horch, President of the Roerich Museum, and Mrs. S. G. Lichtmann, Vice-President of the Master Institute of the Roerich Museum. The office has been in charge of Miss Kathryn Linden.

Mr. Louis L. Horch has moreover very kindly agreed to supervise a financial campaign for the benefit of the Institute.

On the 15th of October the Himalayan Research Institute arranged a lecture by Professor N. Zavadsky, of the Pasteur Laboratory of the Curie Institute, Paris, on "The Biological Bases of a New Conception of Life."

On December 15th, Mrs. L. L. Horch, President of the Roerich Society, delivered a lecture on "The Valley of the Gods." The lecture was illustrated with motion pictures and slides. Mrs. Horch has made recently a prolonged sojourn in the Kulu Valley.

Extensive preparations are being made for a further development of the Institute's activities for the coming year, 1931.

THE DIRECTOR.

URUSVATI BRINGS AMERICA NEW BOTANICAL TREASURES

By DR. E. D. MERRILL

DURING the past year the Urusvati Himalayan Research Institute of the Roerich Museum has entered the biological field with a view to assembling material and data appertaining to the flora of the Western Himalayan region. In this endeavor the cooperation of the New York Botanical Garden was enlisted. The actual field work in India has been done by Dr. Walter Koelz, and his first season's collections are now available for study. The first set of duplicates, approximately 1,000 specimens, has been received and mounted at New York, and the preliminary identifications are being made by myself, as Director of the New York Botanical Garden.

The objectives are to study in the field and in the laboratory those plants of economic and scientific value, particularly as to their medicinal, or possible medicinal uses, as well as those involved in other ways in the daily life of the people; and to assemble other economic information regarding the qualities and uses of plants, their local names for comparative purposes, and similar data that will be of significance to the general field operations of the Roerich Museum and its artistic, economic, and scientific program.

This is a field of much promise, opening up new vistas and broadening the scope of the activities of the two cooperating institutions, the Roerich Museum and the New York Botanical Garden. It is an example of productive work fostered by the Roerich Museum and furthered through the voluntary cooperation of the Garden, to their mutual benefit.

While considerable field work has been done in the past in the northern Punjab, intensive work in any particular area in the region constantly brings to light new forms, and unquestionably a number of undescribed species will be found in the collections available and those being assembled. During the 1930 season, Dr. Koelz operated chiefly in Lahul, at an altitude of about 13,000 feet, and in the vicinity of Kulu. It is his plan to cover all of the botanically interesting regions in the general vicinity of Kulu and in Lahul, extending his field work, as possible, into the more remote and inaccessible areas.

The scientific value of the collections already assembled is very great, and duplicate sets of the specimens will be available for study in various institutions in Europe and in America, supplementing the original collection preserved at Kulu.

The Himalayan flora is a very diversified and interesting one, containing many species of marked beauty, and others of great economic importance. The region is one of an exceedingly diversified topography, with great ranges in altitude, great variation in temperature and in the seasonal distribution of the rainfall, factors that favor the development and persistence of a very rich flora. Few parts of the world can be compared with this particular area in the richness and in the economic and scientific value of its plant life. It is to be hoped that the work so auspiciously initiated in 1930 can be maintained and amplified, not only for the work in itself but also for the prestige of the cooperating institutions.

HEADQUARTERS OF THE INSTITUTE AT NAGGAR, KULU.

THE INSTITUTE'S HIMALAYAN HEADQUARTERS

By V. SHIBAYEFF

IN THE northern part of the Punjab begin the Himalayan foothills, rising in their majestic heights to the long string of mountain peaks which have no equal in the world.

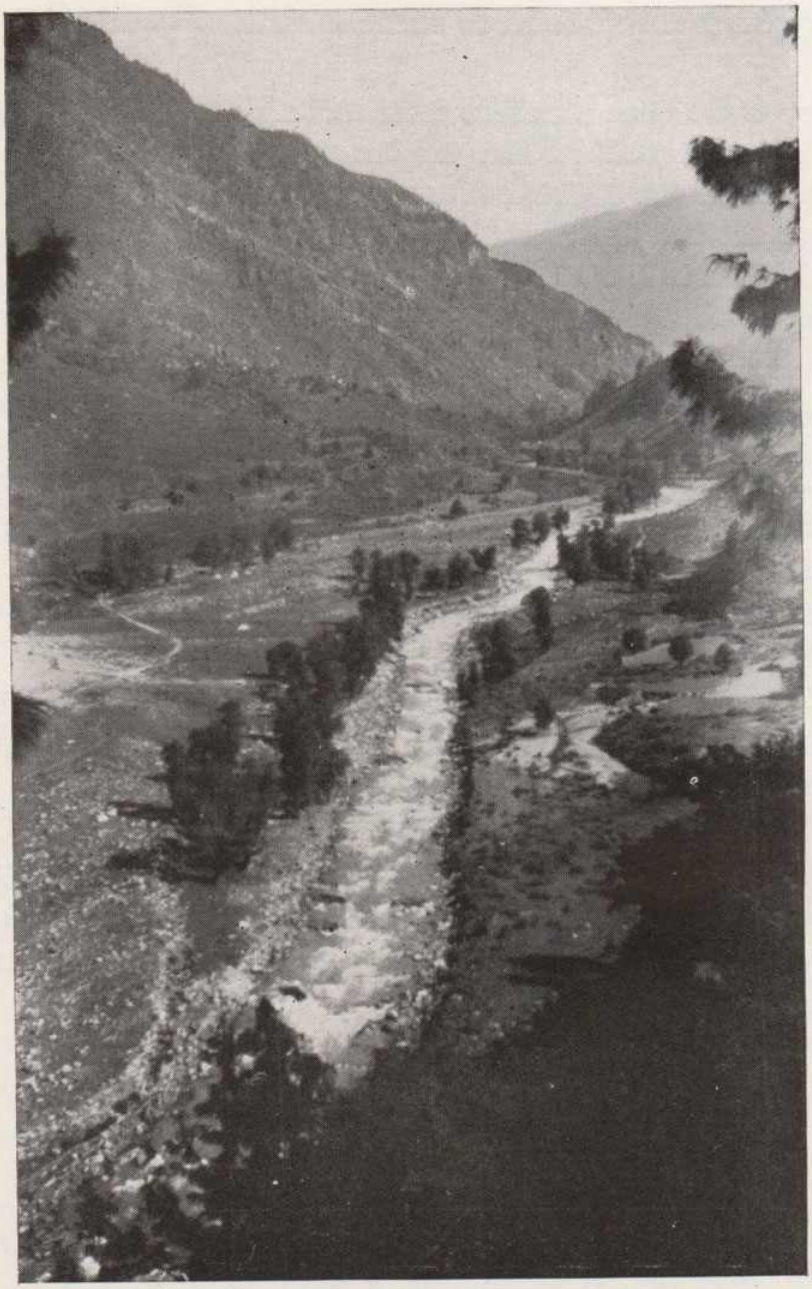
Going northward through the Punjab, passing Amritsar and Pathankote, one reaches Jogindarnaggar, the last station of the narrow-gauge extension of the North-Western Railway. From here the journey continues by motor car, through Mandi and thence along the river-bed of the Beas, the last stage Alexander the Great ever reached in his eastward campaigns. Along the Beas the motor road runs through most picturesque mountain gorges, and on the second day of motoring one enters Kulu Valley. The river-bed rises from a 4000 foot elevation near Aut to 6000 at Manali, with mountains on both sides 10,000 feet to 14,000 feet high, rising up to almost 20,000 feet at the northern end of the Valley, the mouth of the Beas.

The vegetation of Kulu Valley is extremely rich—the fields yielding up to three crops yearly without apparent exhaustion. Maize is 13 feet high. Beautiful stretches of amaranth decorate the lower slopes and green pine forests cover the upper heights. The numerous orchards give abundant crops of first class cherries, apples, pears, plums, peaches, apricots and nuts. Higher up, but quite near by, the chain of snow-clad ranges stands out against the blue sky—all this makes indeed a most beautiful picture.

Here, in the center of the Valley, at an elevation of 6000 feet, N. Latitude of 32° 7′ and E. Longitude of 77 ° 10′, are the Headquarters of Urusvati, Himalayan Research Institute, uniquely and beautifully situated, for the latitude is the same as that of Algeria and yet in winter the whole Valley is under snow. It is therefore no wonder that these exceptional conditions of nature also give rise to unequalled climatic, magnetic and botanical conditions, and that the richness of scientific possibilities and investigations may be considered almost inexhaustible.

The Headquarters' buildings are situated on a ridge, the southwestern slope of which forms the side of the Beas, the northern slope descending to Chhaki River, a side-stream of the Beas. The house is surrounded by tall old deodars and commands a view over the whole Valley. The building is earthquake-proof, and has two stories: the upper consisting of spacious living quarters for the members of the Institute's staff, and a long glass veranda; the lower housing the Institute's Museum and Library, and also surrounded by a wide veranda on three sides.

The Museum is growing so rapidly that, in less than a winter, the accommodation has become too small. The botanical collection covers the whole of Kulu and the adjacent Lahul and Kangra districts, and consists at present of well over 5000 plants. The zoological collections (birds and mammals) cover the same regions and include



View of Kulu Valley from Urusvati, base of Himalayan Research Institute

well over 1000 skins. The geological and archaeological collections are in the making, and a meteorological shelter is at present under construction. The medicinal properties of the many Himalayan varieties of plants are being investigated and are proving to be of colossal value to humanity.

The Library has a large number of scientific volumes which is being continually augmented.

Kulu Valley is the famous ancient route to Ladak and Tibet. Ancient temples are strewn all along the road. There are hot springs in Kulu and in the adjacent Pharbati Valley, where the natives cook rice (rice is actually cooked in the stream) and, remembering the tremendous earthquake on April 4th, 1905, when according to official data 1127 persons and 17,192 animals were killed, one understands that subterranean conditions also play a great part in the remarkable fertility of the Valley and the exceptional magnetic and climatic conditions.

The annual rainfall is not excessive at Naggar, being 49.40 inches (from a 27 years' average); and the lowest mean monthly temperature is 35.3°, in February, and the highest 78.7°, in August, (taken from an average of 21 years). For the higher altitudes, a decrease of 3° in temperature per 1000 feet of elevation has to be allowed.

Let me conclude with a passage from the President-Founder's latest book, *Shambhala*. Prof. de Roerich writes:

"Urusvati—the abode of research, the abode of science, is built in the Himalayas, within the boundaries of ancient Aryavarta. Again the human spirit, purified by the continuous currents of the Himalayas, will search in untiring labor. The healing herbs, medicinal research, wonderful magnetic and electric currents, the radioactivity and all those unspeakable treasures, which are preserved only in the Himalayas . . .

" '*Vade, filii ad Montes Indiae et ad cavernas suas, et accipe ex cis lapides honoratos qui liquefiunt in acqua, quando commiscentur ei*'—so speaks the most excellent Hali, the Arabian, mentioned by Paracelsus.

"Let us go to the Mountains of the Himalayas!"

BOOK REVIEWS

E. DOUGLAS VAN BUREN: *Clay Figurines of Babylonia and Assyria.* Yale Oriental Series, Researches, Volume XVI, Yale University Press, 1930. Pp. LXIX and 287; Pl. LXVIII.

THE last volume of this admirable series, published by the Yale University Press, we owe to Mr. Douglas van Buren who contributes a study of Assyro-Babylonian clay figurines found in vast numbers during the excavations. The term Assyro-Babylonian should be understood here not geographically, but culturally, for the author does not limit himself to Assyria and Babylonia proper, but also includes a rich material from Susa, brought to light by the French Délégation en Perse, of which the lamented Jacques de Morgan was the leader and inspirer. The material gathered in the present book includes finds from most of the famous archaeological sites of Northern and Southern Mesopotamia, such as Eridu with its prehistoric finds, Kish, Surghul and El Hibba, Erech, Larsa, Shurippak, Lagash, Ur, Nippur, Sippar, Babylon, Ashur, Nineveh, and Susa, the capital of Elam.

The author did well not to attempt a chronological classification of his material. The difficulties of establishing a chronology of the terra-cotta figurines are evident, and the problems of different styles and techniques require further study. The material of the book has been grouped according to types and the subject of representation, such as female figures, goddesses, male figures, gods, divine couples, animals, religion and magic, and daily life. These clay figurines very often furnish invaluable data on the everyday life and types of ancient Mesopotamia. Many of them represent votive objects of offering, teraphims, objects illustrating popular beliefs, and images used in the rites of sympathetic magic. In many instances these clay figurines reproduce motifs well-known from the large monumental compositions of the Assyro-Babylonian sculpture. Such are the hunting scene depicting Ashurbanipal spearing a lion, winged demons holding aloft their prey in their talons, and many others. Perhaps, these figurines with miniature reproductions of famous mythical scenes were a kind of religious memento sold in temples to the devotees.

An interesting class of clay figurines is formed by the figurines representing Parthian or other Iranian nomad horsemen. The author describes a number of such figurines, some of them of a very crude workmanship. On Pl. XVII, figs. 81, 82, the author gives the reproduction of one of such riding figurines (origin unknown) which he describes (p. 63, no. 335) as a female riding figure, and dates it as belonging to the first century A. D. I believe the figure represents a nomad horseman (Iranian nomad, possibly Parthian), dressed in a short tunic fastened round the waist by a belt, baggy trousers, and loose leather boots of "Scythian" pattern.

The figure wears not a veil, but the tightly fitting headdress of the Iranian nomads (perhaps made of a coat of mail), which is fastened under the rider's chin, and covers the upper part of his shoulders. The figure sits astride, the legs drawn backwards—a characteristic of the nomad way of riding. His horse is a typical steppe horse with a short body and a rather heavy head; with a broad and well-developed chest and a short and strong neck. The horse's mane is cut according to the steppe fashion. The horse has a bridle and a breastplate which is ornamented with oval plaques (probably made of metal).

The heraldic animal figures of Pl. XLVII, fig. 228, representing two ibexes, and of Pl. XLVIII, fig. 229, strikingly recall the analogical bronze figures from Cappadocia and the newly discovered bronze finds of Luristān in Western Persia (See the article on the Luristān bronzes, published by Arthur Upham Pope in the September, 1930 issue of the *Illustrated London News*). The problem of these heraldic figures, and its Assyro-Babylonian and Central Asian aspects merits a special study.

Mr. van Buren's book is a welcome addition to our knowledge of Mesopotamian culture.

Georges de Roerich.

N. FETTICH: *Bronzeguss und Nomadenkunst auf grund der ungarländischen Denkmäler, mit einem Anhang von L. Bartucz über die anthropologischen Ergebnisse der Ausgrabungen von Mosonszentjános, Ungarn.* Seminarium Kondakovianum, ΣΚΥΘΙΚΑ, 2, Prague, 1929, 4, pp. 96, XVII tables and 16 illustrations in the text.

The Byzantological Institute "Seminarium Kondakovianum," headed by the noted archaeologist Professor A. P. Kalitinsky, has begun since 1929 to issue a series, ΣΚΥΘΙΚΑ dedicated to the study of Scythian and other antiquities left behind by the various nomad tribes of the Eurasian steppe country. The first volume of this series was contributed by Professor M. I. Rostovtzeff, the founder of this new branch of archaeological science. The second volume is due to Dr. N. Fettich, author of numerous important publications on the nomad antiquities of Hungary. The volume contains a detailed study of bronze-cast objects found in Hungarian barrows, as well as a stylistic study of their relationship to the antiquities of South Russia, Siberia, Central Asia and Mongolia. The Hungarian barrow finds are unusually rich and of a very high workmanship, showing a definite artistic style, closely related to the great nomad art of Central Asia. Most of the archaeological material comes from barrows, which are usually found to be situated in large groups or cemeteries. The author gives a list of these cemeteries, and points out the different characteristics of the several

groups of barrows. Some of the groups can be fairly well dated, others need further investigations. The author's researches have definitely demonstrated that the Hungarian bronze-cast objects were left behind by a nomad tribe of a Turkish-Mongol character, and that the constructive elements of this art had come from the great nomad lands of Central Asia. Some of the barrow groups can be definitely ascribed to a nomad race of horsemen. Others are characterized by an apparent absence of side-arms and horse-trappings. The author shows that some of the puzzling metal objects found in the barrows, are nothing but bronze plaque ornaments of saddles and bridles. In some of the graves, the horse skeleton is absent, and the author justly remarks (p. 14) that very often the saddle and bridle replaced the horse. We find similar usages in the barrows of Mongolia. The author mentions the discovery of numerous iron arrow-heads, and it would be highly interesting to draw parallels in the light of the investigations recently conducted by Dr. Paul Rau in the lower Volga region. (Cf. Paul Rau: *Die Gräber der frühen Eisenzeit im unteren Wolgagebiet. Mitteilungen des Zentralmuseums, Jahrgang* 4, *Heft* 1, *Pokrowsk*, 1929).

Most of the discovered bronze-cast objects represent belt buckles, and bronze plaques used as belt ornaments. The two fundamental motifs of this art seem to be the motif of fighting animals, and the foliate ornament, which often degenerates into a geometric composition. According to the author, the motif of fantastic animals has probably some mythological significance (p. 37). He draws attention to the striking similarity which exists between the bronze-cast plaques with human figures of the Hungarian barrows (the 2nd group of barrows) and the plaques with human figures found in the neighborhood of the village Redikor, District Čerdyn, Province of Perm in Northeastern Russia, as well as with some of the finds of the Caucasian and South Russian barrows. Similar to other branches of the great Central Asian nomad art, the art of Hungarian barrows is characterized by the tendency to avoid empty spaces in compositions, which are usually filled in with foliate or floral ornament, or with animal figures ornamentally arranged.

On page 50 the author makes the interesting statement that the bronze-casting form probably had a woodcut model, and that the various bronze-cast objects bear traces of a wood-cutting technic. This important conclusion is not confirmed by actual finds, for the author says:

"*Im zusammenhang mit unseren Bronzegüssen muss ich noch erwähnen, dass im ganzen ungarländischen Material weder eine einzige hierhergehörige Gussform, noch ein zur Herstellung der Gussform dienendes Holzmodell gefunden wurde; auch hat man von Goldschmiedewerkstatten oder Siedlungen bisher keine Spur entdeckt*" (p. 53).

Many of the Hungarian bronze-cast objects are gilded and silvered.

In Chapter III, the author endeavors to find a place for the bronze-cast culture of the Hungarian barrows among the different provinces of the South Russian and

Central Asiatic nomad art. He justly points out that the art of the Hungarian barrows had been brought to the Hungarian plains from afar, and that among the motifs met with on the Hungarian bronze-cast objects we never find ornamental motifs current in contemporary Medieval Europe. The author finds numerous parallels in style and technic with the bronze-cast antiquities of Minussinsk in Southern Siberia, the finds of Kočkar in the Semirečye Province, and even with the recent discoveries of the Japanese archaeologists in Korea. Some of the Hungarian bronze-cast objects (*Komitat Moson*, Vol. VII, pp. 14-19) bear traces of an Iranian influence, and may have come from the Oxus region in Turkestān.

We may add that the bronze-cast buckle and belt ornaments of the Hungarian finds bear a distant resemblance to those of East Tibetan belts, and that the foliate ornament of Hungarian bronze plaques may have originated from the same source as the floral ornaments on the scabbards of Tibetan swords.

The excavations and anthropological investigations of the group of barrows at Mosonszentjános (*Komitat Moson*) have clearly shown that the barrows belong to a nomad tribe of Mongol race, and that the artistic productions of this tribe were closely akin to those of other nomad tribes of the Asiatic steppe country.

Dr. Ludwig Bartucz contributes an enlightened study of the anthropological material of the Mosonszentjános barrows. According to him, "*. . . halte ich es für wahrscheinlich, dass die Leute von Mosonszentjános in ethnischer Hinsicht avarisch waren, und an ihrem Volkstume, an den Sitten ihrer Ahnen auch während ihres langen Verbleibens treu festhielten und sich von jeglicher Rassenvermischung streng abgeschlossen haben. Jedoch hat dieses avarische Ethnikum eine betrachtliche hunnische Komponente enthalten, mit welcher es sich wahrscheinlich nicht in Ungarn sondern bereits im Osten verschmolzen hat*" (p. 95).

Let us hope that Dr. N. Fettich will soon give us a complete inventorium of the Hungarian finds which will, no doubt, throw a new light on the problems of the archaeology of nomad tribes.

GEORGES DE ROERICH.

OWEN LATTIMORE: *The Desert Road to Turkestan*. Little, Brown & Co., Boston, 1929. Pp. XV and 373.

Mr. Lattimore followed in 1926 the little-known desert route from Kuei-hua (Kuku-khoto) through Inner Mongolia to Ku-ch'eng in Chinese Turkestān. This undoubtedly ancient caravan route, known to Chinese caravan men as *jao-lu* or the "Winding Road," has come into prominence as the result of the recent crisis of civil war in Western China and the closing of the trade route across Outer Mongolia. Mr. Lattimore's route was crossed at different times by such explorers as General Prjevalsky, Younghusband, Kozloff and Sir Aurel Stein. The "Winding Road" leaves the Kuei-hua—Sair-usu route at Pai-ling Miao; from here it strikes west-

ward towards Murghulchin and Shandan Miao, and continues past the Etsin-gol basin in a northwesterly direction towards San-t'ang Hu and Ku-ch'eng. The author had no adequate route-maps at his disposal, nor did he conduct a route survey. Notwithstanding these drawbacks his description of the caravan route will prove useful. The total approximate length of the route from Kuei-hua to Ku-ch'eng is equal to 1587 miles, according to the author's reckoning. The author is in general well informed and his fluent knowledge of Chinese has helped him to get first-hand information from his Chinese cameleers. There are, however, some minor points which need correction, especially Mongol names of localities along the route.

On page 43 of the text, the author mentions a ruined wall near to the hamlet of Ts'a-ts'a, situated some forty miles from Pai-ling Miao. The wall runs east and west, and the author believes it to be the ancient boundary of Marco Polo's "Province of Tenduc." It is impossible to discuss this point until a thorough archaeological investigation of all the ruined cities of the Mongol epoch, found in the neighborhood of Kuei-hua, has been made. With the disappearance of the Keräit, the legend of Prester John was passed on to Prince George of the Öngüt, who was killed in Mongolia in 1298 A. D. It was he whom Marco Polo considered to be the Prester John of the legend.

In obtaining the Mongol names of the different localities along the caravan route, the author had to depend on his Chinese cameleers, hence the mis-pronunciation of Mongol names, which are here corrected as far as is possible.

The Boyeh Bogdo of the text (p. 50) should read Baïn Bogdo.

The Mongol trading center of Khara-niuto mentioned on the same page should read Khara-nutu (k), the final consonant being often dropped in the spoken language.

Morghujing on page 95 stands for Murghulchin (or -jin) "pilgrims, travellers," a fitting name for a stage on the desert route. Khara-terugen of page 101 should read Khara-terigun. Modajing of the same page stands for Modachi(n).

It is difficult to reconstruct the Mongol word that hides in the Börhung-wulu of the text (p. 105). The first half of the word doubtlessly contains the frequent Mongol word, *Burkhan,* Buddha, God, Saint. In Mongolia, names of localities and mountains beginning with *Burkhan* are met in thousands and the Börhung-wulu of the text may either represent *Burkhan-burä* "the trumpet of Buddha" (*burä* is often pronounced *pulu* or even *wulu* by Chinese) or *Burkhan-bulag*—"the spring of Buddha," or even *Burkhan-bogdo.*

Khara-mu and *khara-mun* of the text (p. 131) should read *kharmïk* (*Nitraria Schoberi*).

Tukomen Miao should read Tukhumun Miao (p. 137).

It is hardly possible to reconstruct the true Mongol spelling of Laoyingjungwo of page 140.

Dir-su on page 141 does not mean "bad water," but represents *deresün* (*Lasiagrostis splendens*).

P. 185. The author heard the legend of hairy wild men in the Nan Shan mountains, south of Kansu. The same legend exists all over Central Asia from the Himālayas to the Khobdo region in Western Mongolia.

P. 207. Tsevan Rapadu should read Tse-wang Rabden (1716 A. D.).

P. 232. Yunbeize should be Yum-beise.

P. 234. Lattimore is a little harsh on Russian explorers, stating that Madzi for Ma-tsung is "in fact such a classical example of the Russian way of corrupting Chinese pronunciation that, without having heard the correct pronunciation, anyone who has a slight acquaintance with the invincible Russian clumsiness over Chinese names might guess that Ma-tsung was meant."

The author forgets that the region of Ma-tsung Shan is inhabited by a scant population of renegade Torgut and Ölöt Mongols, including several Kirghiz families from the Mongolian Altai, and that the Russian explorer Ladigin (Kozloff's assistant in the Expedition of 1900-01) reproduced the Mongol pronunciation of the Chinese word which is alone understood by the inhabitants of the region. Ma-tsung in its correct pronunciation means nothing to the local Mongol, but Ikhe Ma-dzi Shan and Baga Ma-dzi Shan are familiar names to him.

Chinese Central Asia is full of such corrupt geographical names. For example, the eastern section of the Humboldt Range in Northern Tsaidam is called by the local Khoshut Mongols, Khungu-ūla, which goes back to a Chinese original, Hung-ho Shan—"The Mountains of the Red River" (probably due to the sediments of red lime in the river gorges). Of course, the correct form Hung-ho Shan is not understood by the Mongols, and Khungu is the only accepted name of the range. A good route-map should always show the local pronunciation, as well as the correct name in brackets. On his way, the author visited the site of Ten-pe'i jyal-tsen baishin, known as Kung-p'o Ch'üan to the Chinese caravan men. The story of the "False Lama," as told by the author, is, no doubt, due to Chinese caravan men, and does not correspond to the actual life story of Ja Lama. The life story of the man is given by the author of the present note in his book, *Trails to Inmost Asia* (Yale University Press, 1931). Lattimore had a lucky escape, for even now the country round the castle of Ja Lama is scouted by the remnants of Ja Lama's soldiery.

P. 239. The Chinese *k'ou-k'ou* represents the Khalkha Mongol *khūkhen*, and the Torgut *kökeп*—"girl, young woman."

P. 267. The author mentions a village of T'u-hu-lu, which he believes to represent Tokhara. I believe it is just a Chinese nick-name given to the hamlet, and has no connection with the ancient name of Tokhara.

At the end of the volume we find a useful appendix with the names of the stages along the Kuei-hua—Ku-ch'eng road and their approximate distances.

Sayir-khayir-khan of stage 32 should read Saïn-khairkhan, Shara-khur-usu as Shara-khulusun.

The Metshin Ola of stage 73 is the Mechin (or Mejin) ūla, "The Monkey Mountain."

In his book, the author tells us much about the "Camel-lore," and the Chinese caravan man, his ways of living and occupations during the long eight months' track across the Gobi. In this respect it is one of the best books so far written.

GEORGES DE ROERICH.

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