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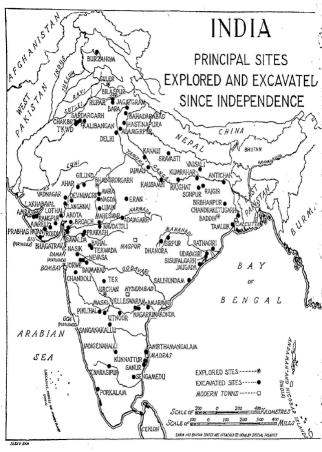
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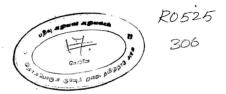
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ARCHAEOLOGY



CULTURAL FORUM

Archaeology Number





Cultural Forum

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Science in the Service of Archaeology

in India



VICE-PRESIDENT INDIA NEW DELHI 8th December, 1961

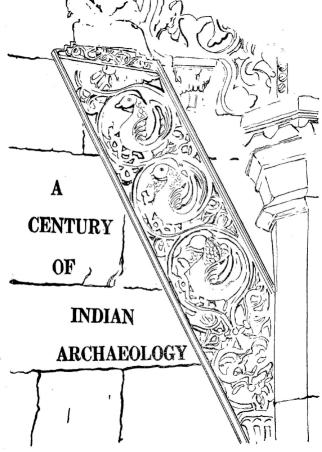
AM glad to know that the December issue of CULTURAL FORUM will be devoted to the subject of Archaeology to commemorate the centenary celebrations of the Archaeological Survey of India.

The development of Archaeology has revealed to us hitherto unknown treasures. It has enlarged our vision and given a new perspective to human history.

Archaeology has unearthed the storied past of India with great success, throwing into bold relief the magnificent achievements of man, in different generations, in this part of the world. The Archaeological Survey of India has done pioneering work in this field in the past hundred years. I have every hope that it will make even greater strides in the years to come.

The discoveries of Archaeology have naturally inspired a sense of pride in the past of India. They have also demonstrated the basic unity and composite nature of Indian Culture, in spite of its diversities at different places and times. Above all, they point to the fundamental fact that Indian society owes its survival to its capacity for fusing and assimilating different cultures. These may well serve as rich resources for promoting emotional integration In India of today.

Nashir



A. Ghosh

THE antiquarian wealth of India started attracting the attention of officers of the British East India Company from the last quarter of the eighteenth century. In 1784, under the initiative and guidance of Sir William Jones, a Judge of the Supreme Court, the Asiatic Society was started in Calcutta, for enquiring 'into the History ... the Antiquities, Arts, Sciences and Literatures of Asia'. Among the organisers of the Society was the Governor General, Warren Hastings, who, ten years earlier, had received a letter from the famous English litterateur Dr. Samuel Johnson. exhorting him to 'examine nicely the Tradition and Histories of the East', 'survey the remains of its ancient Edifices, and trace the vestiges of its ruined cities'. The establishment of the Society provided a great fillip to Asian studies. In 1788, a journal called Asiatick Researches was started, and, in 1814, a museum was established to house the objects collected by the workers of the Society.

Archaeology, in the sense of the investigation and study of the relics of the past, formed, however, only a small part of the activities of the Society. Whatever limited archaeological work, in the form of reports on monuments, was undertaken was not on scientific lines but was mixed with legend and a sense of Much that is absurd was wonder thought and published about Indian antiquities. Nevertheless, some valuable work was done: for example, in 1788, Charles Wilkins provided the key to the decipherment of the early Indian Gupta and kutila scripts; Horace Hayman Wilson's exploration in Afghanistan was notable and the report thereon was remarkable for the age. Stray reports and notices on monuments also appeared.

In 1800, Lord Wellesley, the Governor General, deputed Francis Buchanan to survey Mysore. In 1807, Buchanan was again deputed to survey the topography, history and antiquities of Bengal. During the next eight years, Buchanan surveyed eight districts. Though his report was never published, what little of it was made available in 1838 by Montgomerie Martin gives an idea of the keenness and accuracy of his observations

In 1838, James Prinsep, Assay-master of the Calcutta Mint unravelled the mystery of the Brahmi script: this was followed by the decipherment of the inscriptions of Asoka, the great Mauryan emperor of the third century B.C., and the establishment of his contemporaneity with a few Greek rulers of the west, who are mentioned in his inscriptions. The history of ancient India, the beginnings of the study of which had been laid in the late eighteenth century, if not somewhat earlier by the identification of Sandrakottos of Alexander's chronicles with Chandragupta, the grandfather of Asoka, was now placed on a sound chronological basis.

During this period, notable work was done by James Fergusson, who, for eighteen years (1829 to 1847), conducted an architectural survey of the country and systematically classified the monuments.

Till now, the Government had taken little interest in archaeological matters, except on a few occasions, such as the employment of Buchanan and sporadic efforts to repair the monuments at Agra and Delhi.

In 1844, following a request from the Royal Asiatic Society of Great Britain for the copying of the paintings of Ajanta and other caves and for the preservation of the caves, the Court of Directors of the East India Company decided to form a commission for collecting accurate information about the nature, extent and state of the exist-

ing monuments. Lord Hardinge, the Governor General, proposed that the commission should be preceded by the preparation of preliminary reports on the monuments by qualified persons. Accordingly, a few officers were deputed to survey some monuments, but nothing more was done.

1861 : Establishment of the Archaeological Survey of India

In 1861 Alexander Cunningham, an army engineer, who had already acquired renown by his antiquarian activities. made a bold bid to end the stalemate by impressing upon Lord Canning, the Governor General, the necessity of undertaking a systematic programme of exploration in the country. Canning accepted the proposal and established the Archaeological Survey of India, with Cunningham himself as the Archaeological Surveyor. This was the first time that the Government unequivocally recognised its responsibility in regard to the monuments and remains of the country. At the same time, the preservation of monuments was not to be a function of the Survey or of any other organisation.

From November 1861 to January 1865, Cunningham covered large parts of North India, following the accounts of the ancient Chinese pilgrims Fa-Hien and Hiuen Tsang. He surveyed an enormous number of monuments and remains and fully reported on them with elaborate illustrations. Unfortunately, the Government, for reasons unknown, decided to abolish the Survey in 1865.

During the next five years some attention was paid to the photographing of monuments and preparation of casts of architectural pieces, but no real work was done. In 1870, Lord Argyll, the Secretary of State for India in the British Government, realised that something more substantial should be undertaken and that could be possible only by a Central organisation. As a result, the Archaeological Survey of India once more came into being, with Cunningham as its first Director General. He was this time helped by two (later on three) Assistants.

During the next fourteen years, up to 1885, Cunningham and his Assistants travelled up and down the whole of east India. discovering north and remains, revisiting monuments and old ones and bringing to light coins, inscriptions, sculptures and other antiachievements guities. These summed up by Cunningham himself in the following words: 'I have identified the sites of many of the chief cities and most famous places of ancient India, such as the rock of Aornos, the city of Taxila, and the fortress of Sangala, all connected with the history of Alexander the Great. In India I have found the sites of the celebrated cities of Sankisa, Sravasti and Kausambi, all intimately connected with the history of Buddha. Amongst other discoveries I may mention the Great Stupa of Bharhut, on which most of the principal events of Buddha's life were sculptured and inscribed. I have found three dated inscriptions of King Asoka, and my assistants have brought to light a new pillar of Asoka, and a new text of his rock edicts in Bactrian characters, in which the whole of the 12th edict is complete. I have traced the Gupta style of architecture in the temples of the Gupta kings at Tigowa, Bilsar, Bhitargaon, Kuthera, and Deogarh, and I have discovered new inscriptions of this powerful dynasty at Eran, Udayagiri and other places.'

Considering the extent and fruitfulness of the work done by Cunningham, this is a jejune estimate of his achievements.

Cunningham's survey covered only north and east India. To cover west India, an Archaeological Survey of West India was constituted in 1873 under James Burgess, to whose charge was added the Archaeological Survey of South India in 1881.

In 1873, the Supreme Government of India issued instructions to the local governments to preserve monuments. In 1878, however, Lord Lytton, the Governor General, realised that the preservation of monuments should be the responsibility of the Supreme Government itself, for he 'could not conceive of any claims upon the administrative and financial resources of the Supreme Government more essentially imperial than this'. This resulted in the appointment of H.H. Cole as the Curator of Ancient Monuments in 1881. During the next two years Cole did satisfactory work, but the post was abolished in 1883, and preservation of monuments once more became the vague responsibility of the local governments.

Cunningham himself took great interest in the collection and decipherment of inscriptions but, at the same time, felt that the available inscriptions should be systematically published according to the dynasties to which they belonged. Accordingly, John Faithful Fleet was appointed Government Epigraphist in 1883 for a period of three years. In 1886, E. Hulzsch was appointed Epigraphist for south Indian inscriptions

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Cunningham finally retired in 1885, to be succeeded in the following year by James Burgess as Director General. But the functions of the Director General were to a very large extent decentralised, as there were now three local Surveyors in north and east India, with Burgess in direct charge of west and south India. The system was too complicated to be effective

Burgess retired after three years. and the Government decided to abolish the Archaeological Survey of India as a Central organisation. All archaeological work devolved on the local governments, with the result that hardly any progress was recorded. An attempt was even made to transfer the work to the Asiatic Society of Bengal, which, however, refused to undertake the responsibility: the Society's decision was undoubtedly wise, for then (as now) any country-wide co-ordinated work could only be done by a well-knit Central organisation.

This state of affairs continued till 1898, when the Government woke up to its responsibilities once more and proposed to divide India into five Circles for the purpose of preservation of monuments, each under an Archaeological Surveyor. The scheme was approved for a short period of five years.

Period of Decision (1899-1903)

Soon after his arrival in India in 1899 as Governor General, Lord Curzon realised the chaotic condition into which Indian archaeology had fallen in the absence of any Central leadership. He

noticed that hardly any local government was interested in archaeology, with the result that 'not merely are beautiful and famous buildings crumbling to decay, but there is neither principle nor unity in conservation or repair'. 'Were Germany the ruling power in India', he stated, 'I do not hesitate to say that she would be spending many lakhs a year on a task to what we have hitherto rather plumed ourselves on our generosity in devoting Rs. 61,000, raised only a year ago to 88,000'. In his famous address to the Asiatic Society of Bengal on the 6th February 1900, he declared: Epigraphy should not be set behind research any more than research should be set behind conservation. It is, in my judgment, equally our duty to dig and discover, to classify, reproduce and describe, to copy and decipher and to cherish and conserve.' His conception of archaeology was therefore comprehensive: it included exploration, excavation, research, epigraphy, publication and preservation of monuments and establishment of museums.

Curzon lost no time in giving shape to his ideas, with the result that a new era soon dawned on Indian archaeology. In 1900, he proposed to the British Government the revival of the post of Director General for the supervision and coordination of the work of the Archaeological Surveyors. He also proposed that the Central Government should give grants-in-aid to the local governments to the extent of a hundred thousand rupees per year for archaeological work. This was no doubt a compromise between Curzon's ideal of total centralisation (which, as we shall see below, was achieved two decades later) and the prevailing situation.

The British Government having accepted the proposals, John Marshall came to India in 1902, at the age of twenty-six, as the first Director General of the reconstituted Archaeological Survey of India.

1902-21

JOHN MARSHALL succeeded in organising the archaeological activities of the country in a remarkably short period. Within a few years of his arrival, important monuments, such as those at Delhi and Agra, were thoroughly overhauled. excavation was undertaken at a few important sites and museums received a fillip. In 1904, the Ancient Monuments Preservation Act, steps about the framing of which had been taken in 1898even before Curzon and Marshall-was passed 'for the preservation of ancient monuments, for the exercise of control over excavation in certain places, and for the protection and acquisition in certain cases of ancient monuments and of objects of archaeological, historical or artistic interest'

Five Circles had been sanctioned in 1899 for a period of five years. Marshall insisted on the retention of the Survey on a permanent basis, for 'the work of the archaeological officers is of a kind which cannot be discharged by any other existing agency and it can only cease if the Government cease to admit their responsibility for the preservation of the ancient remains of the country'. In 1906, the Survey was placed on a permanent footing: it was to consist of the Director General, Government Epigraphist and officers for six Circles. to cover the whole of India (including Burma but excluding Mysore, which had its own organisation).

Thus placed on a permanent footing with well-defined policies to guide it, the Survey continued its work with greater vigour and confidence. Hundreds of monuments and sites were declared protected and brought under the purview of the Ancient Monuments Preservation Act. Extensive repairs to monuments and excavations were undertaken. Amateurishness was superseded by professional zeal and technique.

In 1911, the fact that the Survey was almost exclusively in British hands was severely criticised at a conference of Orientalists, with the result that in the following year the Government decided that competent Indians should be appointed to the Survey. It may be mentioned in this connection that in 1921 the Government laid down that forty per cent of the service should be European and the rest Indian. It is needless to say that this rule died out long ago, and the Archaeological Survey of India is now entirely manned by Indians.

In 1921, under the Government of India Act, 1919, archaeology was made a Central subject, so that the Survey became entirely a Central organisation, the Provinces being left merely with the power of declaring monuments and sites protected under the Ancient Monuments Preservation Act. Even this power was transferred to the Centre by the Government of India Act, 1935.

A brief mention may be made here of the excavations carried out by the Survey up to 1920. Under Cunningham, there was a preference for Buddhist sites: Sarnath, Rajgir, Sravasti, Kusinagara and Nalanda, all in the central Ganga valley, Sanchi in central India

and the remains in the North-west Frontier Province received adequate attention: knowledge of Buddhist architecture, art and iconography advanced enormously. Of the city-sites, Bhita and Patna, again in the central Ganga basin. and Taxila in the north-west were evcavated. The first place proved to be a commercial township of pre-Christian origin. Near Patna, the remnants of the Mauryan palace of Pataliputra were laid bare; it was believed that the palace consisted of a wooden structure resting over eighty or more stone pillars. The prolonged excavations at Taxila started in 1913 and continued till 1934. brought to light remains of three successive cities: the earliest. Bhir Mound. originating in about the fifth century B.C., must have witnessed the invasion of Alexander; the second, Sirkap, was established under the Indo-Greeks and had a most systematic town-planning during the days of the Indo-Parthians: and the third, Sirsukh, was established in Kushan times.

1921-28

THIS, in brief, was the commendablerecord of the Survey in the field of excavations when a momentous event took place, viz., the discovery of an ancient civilisation at Harappa in Montgomery District of Panjab and at Mohenjo-daro in Larkana District of Sind, both now in Pakistan. Excavation at the first site was started in 1921 and at the second in 1922. It was realised at the outset that the relics of the culture exposed at these two places (now known as the Indus Valley Culture or, more appropriately, the Harappa Culture) were beyond the common range of Indian antiquities till then known. When brief results of the discoveries, which included steatite seals with strange writings on them, were published in London in 1924, foreign scholars at once noticed that similar seals had been found at some sites in Iraq in levels belonging to the third millennium B.C. The archaeology of India was thus at once pushed back by two thousand years, for till then there was hardly anything which antedated Buddha (sixthfifth century B.C.). All this created great enthusiasm in the country. In 1926, an Exploration Branch was created within the Survey to cope with the increased work.

Such an important discovery could not be left unpursued. Extensive excavations were conducted at both the sites till 1931 and the remains of two large cities laid bare. A comprehensive exploration of Sind and Baluchistan was undertaken between 1925 and 1931. In Sind, apart from the discovery of a large number of smaller stations of the Harappa Culture, an outstanding discovery was an earlier culture at Amri and a later culture at Jhukar and Chanbudaro. In Baluchistan were discovered a large number of sites belonging to various dates, some earlier and others later than the Harappa Culture.

The other excavations during the period included the Buddhist sites of Nalanda, Paharpur and Nagarjunakonda.

Since 1928

Masshall retired from the office of the Director General in 1928. Three years later, an all-round reduction in expenditure was in the air, as a result of which, in 1932, the Exploration Branch was done away with and funds for even the normal work of the Department were drastically curtailed.

In the same year, to encourage outsiders, including foreigners, to undertake excavations, the Ancient Monuments Preservation Act was amended. Taking advantage of this, the American School of India and Iranian Studies and the Boston Museum of Fine Arts jointly excavated at Chanhu-daro in 1935-36. In 1935, the Yale and Cambridge Universities sent a geological cum prehistoric expedition to India under the leadership of Helmut De Terra. The expedition did most valuable work in the country, particularly in the northwest.

In 1939, the excavation technique and policies of the Department came under severe criticism from a distinguished British archaeologist, Sir Leonard Woolley, who had been invited by the Government to advise on the future policy on exploration and excavation. The condemnation, if largely based on hurried observations and prejudices. was not altogether uncalled for, for the fact was that Indian archaeologists had not kept in touch with the techniques of excavation improved in Europe and America, with the result that the methods followed by them were antiquated. Hardly any attempt had been made to establish sequences of cultures by deep excavations, and there was no systematic plan about the choice of sites to be excavated, so that the archaeology of large parts of the country had remained in the dark.

Between 1940 and 1944, the Department undertook extensive excavations at Ahichchhatra in the upper Ganga valley and established for the first time a cultural sequence of the region from the second half of the first millennium B.C. to about A.D. 1100.

In 1944, Dr. Robert Eric Mortimer Wheeler was appointed Director General. During the next four years of his stay in India, the Survey witnessed an all-round progress. He reorganised its Circles and Museums and trained its officers and outsiders in modern methods in his excavations at Taxila, Arikamedu near Pondicherry on the east coast, Harappa, and Brahmagiri in the lower Deccan. Each of these excavations brought forth significant results. Thus, in Sirkap, the second city of Taxila, the stratigraphic relationship between its defences and the habitation inside was established. At Harappa was laid bare a tremendous defensive wall unnoticed before; also was identified and excavated a cemetery of the Harappa Culture. At Brahmagiri a chalcolithic culture of the first millennium B.C. was brought to light and the chronology of the great south Indian Iron Age megalithic complex, till then an enigma, was placed on a sound footing.

In 1950, the Constitution of India made far-reaching changes in the official position of archaeology: instead of archaeology being a completely Central subject, as laid down in the Government of India Acts, 1919 and 1935, it prescribed

 ancient and historical monuments and archaeological sites and remains declared by or under law made by Parliament to be of national importance should be in charge of the Central Government;

- (2) ancient and historical monuments not belonging to the first category should be in charge of the State (Provincial) Governments; and
- (3) both the Central and State Governments will have jurisdiction over archaeological sites and remains not belonging to the first category.

In pursuance of this, Parliament, in 1951, passed an Act declaring to be of national importance all the monuments and sites which had been previously protected under the Ancient Monuments Preservation Act, together with a large number of those situated in such States as were in pre-Independence days called the princely states, over which the Government of India had till then no archaeological jurisdiction before.

Archaeology in the States

No review of the archaeological history of the country would be complete without a reference to the archaeological work in the princely states prior to their merger in the Indian Union. Mysore had its own organisation since 1900, to be followed shortly afterwards by Kashmir, Pudukkottai and Mayurbhanj. Later on, Hyderabad, Gwalior, Tranvancore, Cochin, Bhopal, Baroda and Jaipur joined the list. While some of them functioned sporadically and perfunctorily, others did valuable work in protecting and preserving the monuments in their charge and even undertook excavations. A few other States. without regular organisations, were helped by the Central Survey with finances and advice

Following the disappearance of all princely states with the Independence of India and the taking over of their important monuments by the Central Government as monuments of national inportance, a large part of the staff of the Departments of Archaeology of those States where such Departments had existed was taken over by the Central Survey in 1953. In 1959, the staff and important monuments of Jammu and Kashmir were similarly taken over.

While, therefore, there has been, in certain aspects, an archaeological integration of the country after Independence, there are simultaneously operating some centrifugal forces arising out of the provisions of the Constitution, which, it will be recalled, lays down that ancient and historical monuments not of national importance should be in the charge of the States and that these States will also have concurrent jurisdiction over archaeological sites and remains also of not national importance. This implies that all States should individually set up their archaeological service and promote legislation for the protection of monuments and for the regulation of excavation of sites in their charge. Those States which are, in a way, the successors of the pre-Independence princely states, continue to maintain their archaeological organisations (where they existed before), sometimes attenuated by the Centre having taken over parts of their staff; others are gradually coming up with the necessary legislations and organisations. The Central Government has readily agreed to encourage them in these endeavours and is prepared to give grantsin-aid for excavation and preservation of certain classes of State monuments

The States have a great archaeological role to play. No Central body, however large, can effectively take care of all the monuments that stud the large country—some of them the focus of local pride and sentiment. Even if they are not of any outstanding historical, archaeological or architectural importance, they are nevertheless worthy of preservation for posterity. Some State Governments have not only taken, within a short time, steps in this direction but have also undertaken important explorations and excavations.

Universities and other Institutions

A happy sign of the present-day archaeological activities in the country is that many institutions, including universities, have come forward to undertake archaeological work. The first such institution was the University of Calcutta, which excavated at Bangarh in east India as early as 1937-41. During the last ten years or so, invaluable work has been done by the Deccan College Postgraduate and Research Institute, Poona, K.P. Javaswal Research Institute, Patna, and the Universities of Allahabad. Saugor, Baroda and Calcutta. New and welcome entrants into the field are the Universities of Varanasi and Patna.

International Collaboration

INDA has been intimately connected with the archaeological and museological organisations of UNESCO almost from their very inception. Members of the Archaeological Survey have uniformly been corresponding or regular members of the International Committee on Monuments, Artistic and Historical Sites and Archaeological Excavations and of the International Commission on Museums, either as representing the Government or in their individual capa-

cities. India was also one of the early signatories to the 'Convention on the Protection of Cultural Property in the Event of Armed Conflict'. Further, the Survey has fully associated itself with the 'Recommendations on International Principles applicable to Archaeological Excavations', issued by the International Committee.

Lastly, in response to the appeal of UNESCO for the saving of the archaeological treasures of Nubia, the Archaeological Survey will shortly send out a team for the excavation of a prehistoric site in that region. It is in the fitness of things that after a century of fruitful existence the Survey should now project its activities beyond the frontiers of its country.



THE ARCHAEOLOGICAL



SURVEY OF INDIA

Y. D. Sharma

URING the last one hundred years of its existence, the Archaeological Survey of India has passed through a series of vicissitudes, which have not merely brought about its complete transformation from a humble beginning to a large organisation but have also effected its integration on a rational and comprehensive basis. The incipient structure which came into being in 1861, with the appointment of Alexander Cunningham as the Archaeological Surveyor, has grown into a solid pyramid with an organised multitude of workers at the base and the Director General of Archaeology in India at the apex. The limited aim of merely exploring the antiquities of the country has expanded comprehensively with the passage of time: now the Survey engages itself in exploration, excavation, study of epigraphs, publication, maintenance and preservation of ancient monuments, exhibition and preservation of ancient relics and preparation of multiform records.

The Survey functions as an 'attached office' of the Ministry of Scientific Research and Cultural Affairs of the

of the Survey is located at New Delhi. with the Director General of Archaeology in India at its head. He is assisted by a Joint Director General, three Deputy Directors General, respectively holding charge of administration, exploration and ancient monuments, an Archaeological Engineer and an Assistant Engineer and an Assistant Superintendent. The Archaeological Engineer advises the Director General on the maintenance of and repairs to monuments and scrutinises the works-estimates prepared for that purpose. A School of Archaeology, which was

Government of India. The Directorate

The Survey discharges its duties and responsibilities through the following executive units:

inaugurated only in 1959, functions as an

integral wing of the Directorate.

The Circles, numbering ten; the Excavations Branch; the Prehistory Branch; the Epigraphy Branch; the Chemistry Branch; the Gardens Branch and the Museums Branch.

Besides, there are certain special projects, requiring a short or long duration for their completion, which are

executed by additional ad hoc units. Thus, at present, there are the Atlas Branch, for the preparation of an exhaustive and authentic archaeological

atlas of India, two Temple-survey Projects, one for the south and the other for the north, and the Nagarjunakonda Excavation Project, which has more or less completed its task of excavating the area which will shortly be submerged by

the Nagarjunasagar Dam in Andhra

Pradesh. The Circles

ancient monuments declared by Parliament as of national importance and research into the ancient relics of the country by exploration and excavation constitute the two main functions of the Archaeological Survey. The former wholly and the latter partly are attend-

MAINTENANCE and preservation of

be preserved, excavated or explored lie. As mentioned earlier, originally exploration alone was on the programme

ed to by the Circle in the jurisdiction of

which the monument and site or area to

of the Archaeological Survey. In 1873, the local governments were instructed to preserve the ancient monuments, and it was only in 1881 that a Curator of Ancient Monuments was appointed, although the post was abolished two years later, when preservation fell once more to the charge of local governments. It was only in 1919 that the Government of India Act fixed the responsibility, entirely on the Central Government.

The distribution of the Survey on a geographical basis has also passed through several stages. To the original Archaeological Survey headed by Cunningham, which covered only northern and eastern India, an Archaeological Survey of West India was added in 1873. and another for South India in 1881. After Cunningham's retirement in 1885. three local Surveyors were appointed for northern and eastern India, and James Burgess, became the Director General. With his retirement in 1889, the Archaeological Survey ceased to function and the local governments took up whatever archaeological work found favour with them. In 1899, India was divided into five Circles, each under an Archaeological Surveyor, who was to function under the local government having a major interest within his jurisdiction. The number of Circles was increased to six in 1906 after John Marshall became the Director General of the Survey, and it rose to nine in 1953 with the assumption of the responsibility of monuments under the former princely states. With each addition to the number of Circles there was a re-distribution of their jurisdictions. The State of Jammu and Kashmir was added recently as a separate Circle. The Circles and their headquarters today are: (i) Frontier Circle, Srinagar; (ii) North-Western Circle, Dehra Dun; (iii) Northern Circle, Agra; (iv) Central Circle, Bhopal; (v) Mid-eastern Circle, Patna; (vi) Eastern Circle, Calcutta; (vii) South-eastern Circle, Visakhapatnam; (viii) Southwestern Circle, Aurangabad; (ix) Western Circle, Baroda; and (x) Southern Circle, Madras.

At the head of each Circle, except the Frontier Circle which has only a Superintendent, there are a Superintendent and an Assistant Superintendent. There is an Assistant Engineer in some Circles to render advice on conservation and to estimate, supervise and sometimes execute works. The maintenance and repairs of monuments, which form the main obligation of a Circle and account for the major part of its expenditure, are attended to by Conservation Assistants or sub-overseers, who are each in charge of a sub-circle, six or seven of which comprise a Circle. While the maintenance of monuments within the jurisdiction of a sub-circle is thus looked after by a Conservation Assistant or a sub-overseer, an important group of monuments may have a Custodian or a Caretaker. The former also attends to the repairs to the monuments; the latter is merely charged with the general upkeep of the monuments in his charge. The watch-and-ward of a monument at the lowest rung rests with a monument attendant or watchman. The periodical cleaning and day-to-day minor repairs are carried out by monument cleaners and masons. Similarly, delicate work, such as restoration of inlay, etc., is attended to by engravers. Repairs to some monuments require the help of modellers to ensure proper repairs to damaged sculptures. The technical staff of a Circle also includes photographers, surveyors and draftsmen, who prepare the required records and illustrations for publication and other purposes.

A Circle may also undertake limited excavations, which are carried out by the superintendent or assistant superintendent helped by a technical assistant. A village-to-village survey of the antiquarian wealth of the country is being carried out by four exploration assistants in each Circle under the Five-Year plans. These exploration assistants aim to cover all the places in a District for recording information on the existing ancient monuments and other antiquities. Also under the Plans, three posts of Surveyors have been sanctioned in each Circle in order to prepare siteplans of protected monuments and their environs, which have not been planned so far. The aim of this project is to define the protected areas, so that encroachments may be stopped in future.

The Excavations Branch

ORIGINALLY exploration and extraction were the concern of the entire organisation of the Archaeological Survey. It excavated several historical sites, most of them Buddhist. With the discovery of Harappa, and Mohenjo-daro and commencement of excavation there in 1921 and 1922 respectively, there was a substantial increase in the responsibilities and activities of the Survey, and an Exploration Branch came into being in 1926. It was, however, abolished in 1932 with other drastic retrenchments consequent upon a world-wide general economic depression.

In 1944, shortly after assuming the Director Generalship of the Survey, Dr. (now Sir) R.E. Mortimer Wheeler created an Excavations Branch, with an Assistant Superintendent, later raised to the status of a Superintendent, at its head. The Branch is now quartered at Nagpur and is equipped in men and material to undertake major excavations in the country.

The Prehistory Branch

PREHISTORY remained neglected in the Archaeological Survey for a long time, and it was only under the re-organisation carried out by Dr. Wheeler that the post for prehistory. of the status of an Assistant Superintendent, came into being for the first time in 1945. To cope with the increased work, the post of a Superintendent for prehistory was added in 1957. The Branch is now stationed at Nagpur and its jurisdiction extends over the entire country.

The Epigraphy Branch

EPIGRAPHICAL research has played a major role in strengthening archaeology in India, for it was the decipherment of the Brahmi and Kharoshthi scripts in the second quarter of the last century that placed Indian archaeology for the first time on a firm chronological foot-Although Cunningham, the first Archaeological Surveyor, was mainly pre-occupied with exploration, he also made important contributions to epigraphy, but the founding of the Indian Antiquary by James Burgess in 1872 gave a new impetus to epigraphy. In 1881, Cunningham recommended the institution of an Epigraphical Survey under the direction of John Faithful Fleet, who was appointed as Government Epigraphist in 1883, initially on an experimental basis for a term of three years. Burgess recommended the creation of a post of an Epigraphist for Sanskrit, Pali and Dravidian languages, and when his scheme was approved, Dr. E. Hultzsch was appointed Epigraphist for South India in 1886, also for a term of three years. With the termination of Fleet's appointment in 1886, epigraphy in other provinces also came under the jurisdiction of the Archaeological Survey. In 1888, Burgess started the publication of Epigraphia Indica, while Hultzsch continued to be in charge of epigraphy in South India.

In 1898, new proposals were submitted for the re-organisation of archaeological research, which included a special status for epigraphy. It was decided that the post of Government Epigraphist would be made permanent as long as Hultzsch continued to hold it. In 1900, Lord Curzon, while pleading for archaeology as a whole, laid special emphasis on epigraphy. In 1906, when the Survey was placed on a permanent footing, the post of Government Epigraphist for India, in lieu of the Government Epigraphist in Madras, was created on a permanent basis for the first time.

With its headquarters at Ootacamund, the Epigraphy Branch now consists of the Government Epigraphist, two Superintendents and three Assistant Superintendents, in addition to Epigraphical Assistants and other staff. Apart from the study of inscriptions brought to their notice by others, the Branch carries out regular exploration for location and collection of inscriptions and edits and publishes them.

The Arabic and Persian inscriptions were originally attended by a part-time Epigraphist. Later, in 1945, the post of an Assistant Superintendent was created; this has now been raised to the

status of a Superintendent. The headquarters of the unit are at Nagpur.

quarters of the unit are at Nagpur. The Chemistry Branch

HARDLY any chemical treatment and preservation of monuments and antiquarian objects had been attempted before 1917, when an Archaeological Chemist was appointed in the Survey for the first time, and applied chemistry harnessed in the service of archaeology. In 1945, the post of an Assistant Archaeological Chemist was added to cope with the expanding responsibilities of the Survey; the incumbent of the new post was put on certain important assignments in the south, although chemical work was not distributed vet on a geographical basis. Recently, however, the Chemistry Branch has been organised on a rational geographical basis.

Archaeological Chemist in India, with headquarters at Dehra Dun, is the head of the Branch; the country has been divided into two regions, Northern and Southern, each working under an Assistant Archaeological Chemist, with headquarters at Dehra Dun and Hyderabad respectively. The actual work of chemical treatment and preservation is, however, executed by zonal offices, each under a Junior Archaeological Chemist. There are four zones, Northern, Eastern, Southern and Western, with headquarters at Dehra Dun, Bhubaneswar, Madras and Aurangabad respectively, the former two under the Northern Region and the latter two under the Southern Region. The Northern Zone operates in the area covered by the Frontier, North-western, Northern and Central Circles, the Eastern Zone in that by the Mid-eastern and Eastern Circles, the Southern Zone in that by the Southern and South-eastern Circles and the Western Zone in that by the South-western and Western Circles.

The over-all administrative and technical charge of the entire Branch vests in the Archaeological Chemist, who also attends to the study of and research in wider scientific problems, such as analysis of soil-samples, material identification of organic, inorganic and ceramic objects, and development of suitable methods of treatment and preservation of monuments and antiquities, for all of which his laboratory at Dehra Dun is adequately equipped. The zones attend to the chemical treatment and preservation of objects in departmental museums and of monuments within their jurisdiction under the guidance and supervision of the regional offices and with the assistance of technical personnel, such as chemical assistants, photographers, draftsmen, modellers and laboratory assistants.

The study of geochronology and environmental archaeology has been iniitated recently, initially under the Five-Year Plan, by the appointment of an additional assistant archaeological chemist, to work under the guidance and supervision of the archaeological chemist.

The Gardens Branch

JOHN MARSHALL Introduced gardens in and around ancient monuments as part of the measures for their preservation, particularly where a garden formed part of the original lay-out of the monument. The operations were not, however, carried out directly by the Survey. It was only in 1947 that a

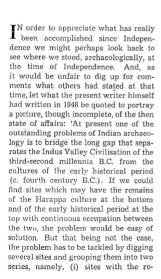
Superintendent and an Assistant Superintendent for Gardens, within the Survey, were put in charge of horticultural work in archaeological areas: the Gardens Branch thus came into being. The field of its operation was initially restricted more or less to Delhi, and was later extended to Agra. With this and other extensions in its coverage, the Branch was strengthened by the addition of another Assistant Superintendent. It has now been reorganised recently on a rational and comprehensive basis, with the garden superintendent, with headquarters at Agra, holding the overall administrative and technical charge of the branch, the actual execution of horticultural operations being carried out by one of the three zones into which the country has been divided. These zones, called Northern, North-western and Southern, with headquarters at Agra, Delhi and Bangalore respectively, are each headed by an Assistant Superintendent, although the last-named zone has yet to come into full commission. The Northern Zone covers the gardens at Agra, Lucknow, Kusinagara, Sarnath. Kumrahar (Patna), Nalanda and Bodh-Gaya and the North-western zone those at Delhi, Dig and Khajuraho; the Southern zone is intended to comprise the gardens at Aurangabad, Nagarjunakonda, Poona, Bangalore, Seringapatam and Bijapur. As new gardens come to be laid or taken over, they will be added to the charge of one of these zones.

The Museums Branch

Till recently, the Archaeological Survey of India had been in charge of archaeological museums under the control of the Central Government, which could be put under four different categories; (1) the Archaeological Section. Indian Museum, Calcutta; (ii) the Central Asian Antiquities Museum, New Delhi, the officer-in-charge of which also held charge over (iii) the local museums of the Survey-all combinedly forming the Museums Branch of the Survey; and (iv) the National Museum, inaugurated on the 15th August, 1949. The National Museum is now an independent organisation. In 1958. objects in the Central Asian Antiquities Museum, together with the attached staff. were made over to the National Museum, and the rest of its staff was mostly placed under the Superintendent, Archaeological Section, Indian Museum. to form the re-organised Museums Branch of the Survey, which now exercises control over the local museums. besides the Archaeological Section of the Indian Museum. The headquarters of the Branch are at Calcutta; it is manned by a Superintendent (who is also the Superintendent of the Archaeological Section of the Indian Museum), assisted by an Assistant Superintendent. The local museums are divided into three zones. the Central. Eastern and Southern, with headquarters at Sanchi, Sarnath and Madras respectively, each headed by a Junior Keeper of Museums. Under each zone there are at present three to six local museums, each in the charge of a curator. The Museum at Nagarjunakonda is an independent zone by itself, in view of its peculiar character.

The existing local museums belonging to the Survey are: the Archaeological Museums at Sanchi, Khajuraho, Sarnath, Nalanda, Bodh-Gaya, Amaravati, Nagarjunakonda, Hampi and Kondapur; the Red Fort Museum, Delhi; the Fort St. George Museum, Madras; and the Tipu Sultan Museum, Seringapatam. It is expected that within a short time new ones will come into being—at Vaisali, Ratnagiri, Konarak, Rupar and Lothal.







B. B. Lal

EXPEDITIONS AND EXCAVATIONS SINCE INDEPENDENCE

mains of the Harappa culture at the bottom and those of later cultures overlying them, and (ii) sites with the remains of the early historical period at the top and of earlier cultures underlying them. Thus, with two fixed points, one at the bottom and the other at the top of the chronological scale, and working from the known to the unknown, in the former series upwards and in the latter series downwards, it would be possible to build up a sequence of the various ancient cultures which would ultimately fill up this gap. 1

Now, while it is not at all claimed that today, in the fifteenth year of our Independence, this gap has fully been bridged, it can certainly be stated that principal piers have been erected and the bridge itself is more than half-way through.

In this great task of bridging the gap, as also in other archaeological field work, it is not the Archaeological Survey of India alone that has done the job; credit, in varying degrees, also goes to State Departments of Archaeology such as those in Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, Mysore, Rajasthan, etc., and to Universities and Research Institutes, such as the Universities of Allahabad, Banaras, Baroda, Calcutta and Sagar, the Deccan College Post-graduate Research Institute, Poona, the K.P. Jayaswal Research Institute, Patna.

The Indus Civilisation-Fresh light

Before Beginning a Survey of the Dark Age between the end of the Indus

Civilisation and the beginning of the early historical period, it may perhaps be worth while to note what light has been thrown, since Independence, on the Indus Civilisation itself. Exploration and excavation have combined to show that this Civilisation need no longer be regarded as confined to the Indus valley, for it is now known to have extended as far east as Alamgirpur² in the Ganga-Yamuna valley in Uttar Pradesh, as far north as Rupar,3 verging on the Siwalik foot-hills in Panjab, and as far south as Bhagatrav.4 on the Kim, a small river, discharging into the Arabian Sea, between the Narmada and Tapti. May be in the future a further extension of the Civilisation is discovered; but even as it is, one notes with a kind of satisfaction, if not pride, that this great Civilisation of the Indo-Pakistan sub-continent covered a much wider area than did the contemporary civilisation either in the Nile valley in Egypt or in the Euphrates-Tigris valley in Iraq.

And that is not all. Excavations at Rupar and Alamgirpur and those at Kalibangan⁵, District Ganganagar, Rajasthan, and Lothal⁶, District Ahme-

- pp. 6-7; and 1954-55, p. 9.
 Explored by S.R. Rao: I.A. 1957-58,
- pp. 14-15.
 5. Excavated by the present writer: I.A.
- Excavated by the present writer: I.A.
 1960-61 (in the press).
 Excavated by S.R. Rao: I.A. 1954-55,
- b. Excavated by S.R. Rab. 12. 1957-58, pp. 16-7; 1956-57, pp. 15-16; 1957-58, pp. 12-13; 1958-59, pp. 13-15; and 1959-60, pp. 16-18.

B.B. Lal, 'Sisupalgarh 1948: an Early Historical Fort in Eastern India', Ancient India, no. 5 (January 1949), pp. 62-63.

Excavated by Y.D. Sharma: Indian Archaeology—A Review, 1958-59, pp. 50-55.
 Hereafter this publication shall be referred to as I.A.

Excavated by Y.D. Sharma: I.A. 1953 pp. 6-7; and 1954-55, p. 9.

dabad, Gujarat, have considerably enriched our knowledge of that Civilisation Located on the southern bank of the now-dried up Ghaggar (ancient Sarasvati) river, the ancient site at Kalibangan comprises two main mounds, a larger one on the east and a comparativly small one on the west. The excavation revealed that whereas in the case of the larger mound the occupation began right on the natural soil, in the case of the smaller mound the houses stood on a high mud-brick platform.7 When one recalls that both at Harappa and Mohenjo-daro there is a set of two such mounds of which the western one has been established to be a citadel, one begins to wonder if the same was not the case at Kalibangan. The site is rich in antiquities, but no less interesting are two potsherds, each with a short inscription (pl. I), the overlaps of letters therein indicate that the direction of writing in the Harappan script was from the right to left and not vice-versa as has been held by some.

The excavation at Lothal has revealed that this Harappan township bristled with great activity on account of the existence of a dockyard (pl. II), measuring 218 metres in length and 37 metres in width and connected by a 7-metre wide channel with the nearby river, Bhogavo. While seals of Harappa culture found, years ago, at several sites in Iraq and a 'Bahrain' seal (pl. III) found recently at Lothal do no doubt point to possible trade connections between India and western Asia during the third and second millennia B.C., the

discovery of the dock-yard at Lothal indicates the modus operandi of this trade. One can now visualise small boats, such as are in fact depicted on the Harappan seals themselves, sailing along the coasts of the Arabian Sea and Persian Gulf, carrying cotton goods, spices, etc., from India and bringing in return cosmetics and the like from western Asia. Indeed, do not the Sumerian records of a comparable date talk of such a trade between that country and the East?

Another new feature revealed at Lothal relates to the burial practice. In some of the excavated graves two bodies lay together (pl. IV). Thus, if the anthropological examination, which is underway, shows that in these cases the persons buried were each a male and a female we might be having here something of great socio-religious import.

The Dark Age-main target

To Come Back to the Dark Age, which admittedly is our main target. Here, perhaps, it may be worth while to deal with the problem region-wise, beginning say with northern India and proceeding gradually southwards.

The excavation carried out during 1950-52 at Hastinapura, located on the right bank of the Ganga in the District Meerut, Uttar Pradesh, brought to light, from bottom upwards, five periods of occupation, with a clear-cut break in between them all.8 The earliest Period was characterised by an ill-fired 'ochre'-red ware, which, on the basis of circum-

^{7.} Surface-observations indicated the existence of a fortification wall along the periphery of the platform. The same, however, remains to be confirmed by excavation.

B.B. Lal, 'Excavation at Hastinapura and other Explorations in the Upper Ganga and Sutlej Basins 1950-52', Ancient India. nos. 10 and 11 (1954 and 55), pp. 5-151.

stantial envidence from sites like Bisauli, Rajpur Parsu⁹ and Bahadarabadi⁰, all
in Uttar Pradesh, seems to be associated with copper objects (popularly
known as Copper Hoards) comprising
harpoons, antennae swords, shouldered
axes, anthropomorphic figures, etc.,
found principally in the Ganga valley
but extending as far south as Kallur
in Andhra Pradesh. As a result, therefore, it has been possible to assign to
these hoards a chronological horizon,
though somewhat vague, namely in the
second half of the second millennium
B.C.

It is, however, to Period II of Hastinapura that pointed attention may be drawn. The inhabitants now used a pottery quite unrelated to the earlier one and known to archaeologists as the Painted Grey Ware. As the name indicates, the ware is grey and bears a variety of painted designs, usually in black pigment. The more common shapes are bowls and dishes of various sizes but items like the lota are also known (pl. V). The houses were made of mud or wattle-and-daub. Agriculture and cattle-breeding seem to have been the main occupation of the people, though hunting no doubt was also quite frequent too. Amongst the domesticated animals particular mention may be made of the horse (Equus caballus), which animal, as far as our present knowledge goes, does not seem to have been used by the Harappans. The tools and weapons were made primarily of copper, although in the upper levels of

the Period iron slags were also met with.11

When about two metres of occupational deposits of Period II had come into being, there occurred a heavy flood in the Ganga which washed away a considerable portion of the settlement. Not only can the traces of this devastation be seen in the form of erosion-marks left on the mound itself (pl. VI) but also some of the washed-away material, though in very fragmentary form, has been encountered in the river-bed, as many as fifteen metres below the waterlevel.

After a lapse of time, the site was re-occupied by people who used the Northern Black Polished Ware, which on the basis of evidence from Kausambi, Lawilla, a etc., may be dated from circa sixth to second century B.C. The flood, therefore, may vaguely be dated to circa eighth century B.C. and the beginning of the Painted Grey Ware occupation, to circa 1100 B.C., if not earlier.

At Rupar and Alamgirpur, the Painted Grey Ware is sandwiched between the Harappa Culture on the one hand and the Northern Black Polished Ware on the other (fig. 1), without any overlap on either side, which evidence more or less corroborates the dating provisionally suggested for the Painted Grey Ware at Hastinapura. In an overall picture, however, the lower and upper

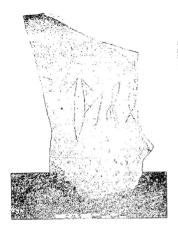
B.B. Lal, 'Further Copper Hoards from the Gangetic Basin and a review of the problem', Ancient India, no. 7 (1951), pp. 20-39.

^{10.} Excavated by Y.D. Sharma in 1952.

More evidence regarding the use of iron by late Painted Grey Ware people has since been obtained from Alamgirpur.

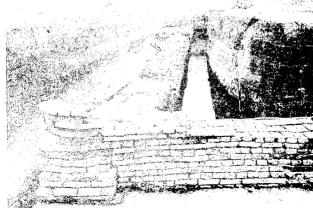
G.R. Sharma, The Excavations at Kausambi 1957-59 (Allahabad, 1960).

Krishna Deva and R.E.M. Wheeler in Ancient India, no. 1 (1946), pp. 55-56.



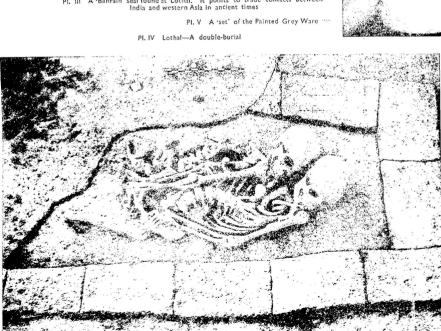
Pl. I Kalibangan (Rajasthan)—a potsherd bearing an inscription in the Harappan script. The overlaps of letters show that the direction of writing was from the right to the left

PI. II Lothal (Gujarat)—A view of the retaining walls of the dockyard



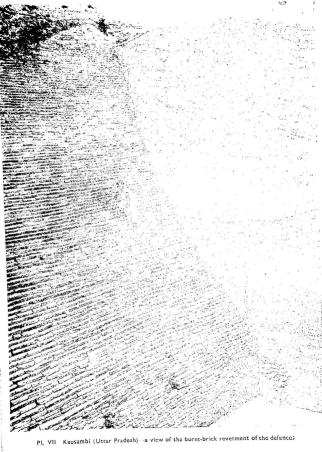


Pl. III A 'Bahrain' seal found at Lothal. It points to trade contacts between India and western Asia in ancient times

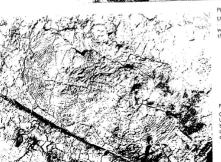


PI. VI Hastinapura (Uttar Pradesh)
—the figure points to the
erosional scar left by a
heavy flood in the Ganga
which washed away a major
portion of the Painted Grey
Ware settlement







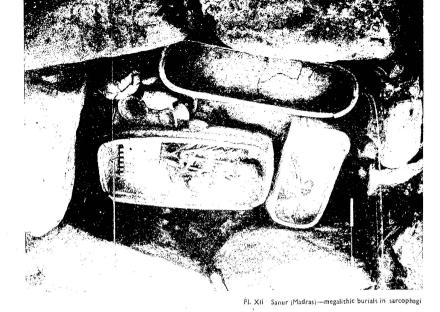


Uijain (Madhya Pradesh)
- a 'caging' of dressed
wooden rafters used in
the reinforcement of
the defences

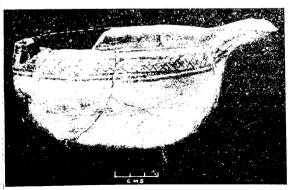
PI. IX

On the defence wall at Ujjain- impressions of baskets left behind by the workmen who were engaged on the construction work

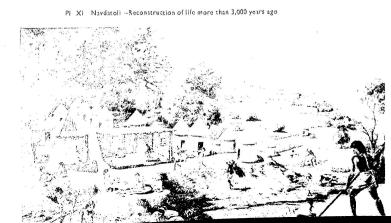




2



PI. X A and B
Channel-spouted bowl and
stemmed cup from Navdatoli (Madhya Pradesh),
which point to Iranian
contacts with India towards the end of the second millennium B.C.

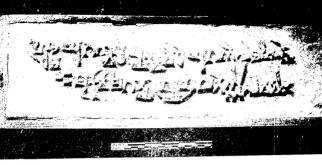




PI, XIII
Burzahom (Kashmir)-bone-tools used by the
'pit-dwellers'

PI. XIV Burzahom typical matimpressed pottery





PLX)

Found at Jagatgram (Uttar Pradesh), the inscription bears testimony to the horse-sacrifices performed by a king called Silavarman in the third century A.D.



I, XVI

An early Gupta terracotta Tamluk (West Bengal)

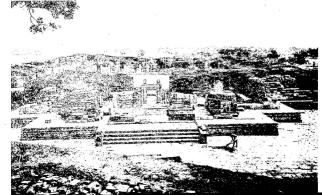




PI. XVIII Sisupalgarh (Orissa) -- gateway-complex of early historical fortifications

Pi. XVII A brick-lined stepped pit (?) at Chandraketugarh (West Bengal)

Pl. XIX Ratnagiri (Orissa)—one of the excavated monasteries

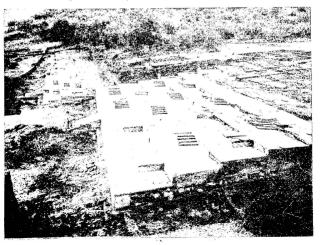




PI, XX Amaravati (Andhra Pradesh)—crystal relic casket discovered in a stupsi



PI. XXI Nagarjunakonda (Andhra Pradesh) a bathing glad built in the early centuries A.D.



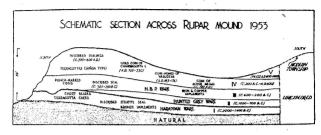


Fig. 1

limits may extend by a century or so each way.

Explorations have revealed that this

Ware occurs up to Lakhiyo Pir (Pakistan) 14 on the west, Vaisalii5 (though in a degenerate form) on the east, Rupar on the north and Ujjaini6 (though in a very restricted number) on the south. The chief concentration of the Ware, in the present state of our knowledge, seems to be in the valleys of the Sutle; Ghaggar (ancient Sarasvati), 17 Yamun and upper Ganga, the more noteworthy sites being, besides those already men-

 Identified in N.G. Majumdar's collection lodged with the Archaeological Survey of India.

 Excavated by A.S. Altekar and Sita Ram Roy: I.A. 1958-59, p. 12. See also K. Deva and V.K. Misra, Vaisali Excavations (Vaisali, 1961).

16. Excavated by N.R. Banerjee: *I.A.* 1955-56, p. 19; 1956-57, pp. 20-28; and 1957-58. pp. 32 ff.

17. A. Ghosh, 'The B its archaeological asper National Institute of ici 1 (1952), pp. 37-42. tioned, Ahichchatra, Kurukshetra, Mathura, Bairat, Kampil, Sravasti, Kausambi (where a very late stage, as at Vaisali and Ujjain, occurs), which figure in one way or another in the Mahabharata storv.

The aforesaid chronological horizon ageographical distribution of the Ware are indeed of great significance: for, as we know at present, they more or less coincide with respectively the time and area associated with the early Aryan stock in India. The situation gets further heightened when one recalls the following verse from the Puranas:

Gangay = apahrite tasmin nagare Nagasahvaye

Tyaktva Nichakshur = nagaram Kausambyam sa nivatsyati.

'When the city of Hastinapura is carried away by the Ganga, Nichakshu will abandon it and will dwell in Kausambi.' For does not this incident seem to find a corroboration, on the one hand, in the occurrence of the flood that washed

Bedetin of the occurrence of the hood that washed specific of ledding at 1977y the Painted Grey Ware occupation at Testinapura, and, on the other,

in the fact that it was only towards the fag-end in the life of that Ware that its users reached Kausambi?

In spite of such strong circumstantial evidences suggesting the association of the Painted Grey Ware with the Aryans, the present writer would like to emphasise, as he had done earlier,18 that until and unless positive ethnographic and epigraphic proofs are obtained the association may only be regarded as provisional.

Continuing the story, in northern India, towards the end of the Dark Age i.e. towards the time of Asoka, whereafter sufficient historical data are available, one may note with gratification the discoveries made at Kausambi, Rajghat, Sravasti and Vaisali At the first-named site has been discovered a palace-fortress, 315 × 150 metres, built of stone-inlime, the facings being of ashlar masonry. According to the excavator, the palace may go back to circa 600 B.C. if not earlier, and may have been occupied by the famous king Udayana, a contemporary of the Buddha.19 Incidentally, it may be added that an inscription recovered from another part of the site, though a few centuries later than the event itself, does confirm the literary evidence that the Buddha had visited Kausambi and stayed at a place called Ghoshitarama.

No less remarkable than the palace are the defences of Kausambi, which, enclosing an overall area of about three square kilometres, consisted of a very wide mud-wall provided on the exterior The work at Vaisali²³ has brought to light a very early stupa, which the excavator is inclined to identify with one that was built by the Lichchhavis over their share of the relics of the Buddha.

While Sonpur²⁴ does not claim of any spectacular or historically important structure, it is important from the purely archaeological point of view as it clearly demonstrates the penetration of the black-and-red ware in the middle Ganga valley in a pre-N. B. P. Ware horizon. No less interesting, but equally intrigu-

with a burnt-brick revetment which even today may be seen soaring to a height of over thirteen metres (p. VII). Defences of comparable antiquity and enclosing more or less similar areas have also been unearted at Sravasti20 and Raighat21 in the Ganga valley and at Ujjain22 in central India. At the lastnamed site the defences were re-inforced on the river side by the construction of a kind of caging of dressed wooden rafters (pl. VIII). In sheer exhaustion and perhans with a sigh of relief, one imagines, the workmen (or women?) left behind their unserviceable baskets on the huge rampart that they were building up (pl. IX).

Excavated by K.K. Sinha: I.A. 1958-59, pp. 47 ff.

^{21.} Excavated by A.K. Narain: I.A.

^{1960-61, (}in the press).

22. See references at no. 16 above.

A.S. Altekar, 'The Corporeal relics of the Buddha', Journ. Bihar Res. Soc., Buddha Jayanti, Special Issue, Vol. II.

^{24.} Excavated variously by V.K. Misra and B.S. Verma (under the general supervision of A.S. Altekar): I.A. 1956-57, pp. 19-20; and 1959-60, p. 14.

Lal, op. cit. (1954 and 55), p. 151.
 I.A. 1960-61 (in the press).

ing, are the polished stone axes recovered from the lower levels of the site.

The above was a brief survey of what has been done to illumine the Dark Age between the Harappa Culture and the early historical period in so far as northern India was concerned. Let us now turn our attention southwards and see what has been the achievement there in this respect.

It is held by some that the Harappa Culture came to a sudden end, the responsibility for this catastrophe being thrown alternatively on sweeping floods or ransacking invaders. It is indeed difficult to imagine the complete wiping out of a people. And this is exactly what has been demonstrated by the excavation at Lothal.25 Here we have in the upper levels (Lothal B) a gradual tranformation of the material culture. New pottery-types begin to show up while the older ones gradually disappear. The seals, so typical of the Harappa Culture, become poorer in execution, there usually being the absence of the animal-figure on them. Likewise, the long ribbon-blades of chert are replaced by smaller ones of agate or chalcedony. Kiln-burnt bricks give way to mud-bricks or even mud. Townplanning and street-drainage become indeed things of the past. The story is further continued at Rangpur,26 about fifty kilometres south-west of Lothal. Here, unconformably overlying a microlithic deposit, are the remains of the Harappa Culture (Rangour II A). Then comes the transitional stage - Rangpur II B, which may broadly be regarded as

equivalent to Lothal B. By the time of Rangpur II C, the new elements, in the form of small blades, Lustrous Red Ware, etc., become increasingly conspicuous. In Rangpur III, the last occupation at the site coming down approximately to the beginning of first millennium B.C., the picture gets so much changed from the original Harappan that had there not been the intermediary stages of Rangpur II B and II C one would not have believed that the inhabitants of Rangour III were indeed survivals of the Harappans. In tracing the history of such survivals in Gujarat, the excavations at Roidi27 and Prabhas Patan28 have also thrown much valuable light.

Such is the story of the transmutation, call it degeneration if you please, of the Harappa Culture in Gujarat. And it is only reasonable to think on similar lines in regard to other regions as well. Indeed, does not the evidence from Bara,29 near Rupar, nay even from the upper Harappan levels at Rupar itself, point the same way?

In this devolution, however, new and even extraneous elements are not altogether barred. For, the post-Harappan time, judging from what had happened in western Asia as a whole, was the 'time of troubles' in which there were great upheavals and large-scale movements of people. In India, the site

^{25.} See references at no. 6.

Excavated by S.R. Rao: I.A. 1953-54,
 p. 7; and 1954 55. pp. 11-12,

Excavated by P.P. Pandya: I.A.
 1957-58, p. 18; and 1958-59, pp. 19-21.

Excavated variously by B. Subbarao and P.P. Pandya: I.A. 1955-56, pp. 7-8; and 1956-57, pp. 16-17.

Excavated by Y.D. Sharma: I.A.
 1954-55, pp. 9-11.

of Navdatoli,30 on the southern bank of the Narmada in District Nimar. Madhva Pradesh, stands a witness to this. Here in chalcolithic levels, assignable on the basis of Carbon 14 tests from circa 1600 to 1200 B.C., have been found certain pottery-types, e.g. channelspouted bowls, stemmed cups (pl. X A and B), vases with plattered mouth, high concave neck and bulging body, etc., which, according to the excavator, are comparable to similar types in Iran. The inhabitants of Navdatoli (pl. XI) lived in wattle-and-daub houses, oblong or circular on plan, domesticated animals, did fishing and carried on agriculture producing, amongst other items, wheat, rice, gram, peas, mung, tivda, kultya, till (sesame), etc.

To the picture of central Indian calcolithic cultures contributions have also been made, in varying degrees, by the excavations at Nagda,³¹ Tripuri,³² Awra³³ and Eran³⁴. Some of these sites also throw light on the cultural contacts which central India had with southern Rajasthan during the protohistoric times. In the latter area have been indentified, at Ahar,³⁵ Gilund,³⁶ etc., the

typical industry of which was, instead of the usual black-on-red ware, a white-painted black-and-red ware. It remains to be seen if and how far this ware ultimately lies at the root of the megalithic Black-and-red Ware.

Passing on from the Narmada valley to that of the Tapti, one comes across two twins of important sites: Prakash37 and Korat, respectively on the northern and southern banks of the Tapti in District Dhulia, and Bahal38 and Tekwada,

remains of a chalcolithic culture the

respectively on the northern and southern banks of the Girna in District Jalgaon. In each case the former site has yielded extensive habitational remains and the latter, burials. The burials at Tekwada today enjoy a key position vis-a-vis later megalithic burials as they include not only fractional remains accompanied by a lithic appendage, though of a feeble kind, but also a black-on-red ware on the one hand and black-and-red ware (with at least one example painted in white) on the other, some of the shapes in the latter ware being comparable to those found in deposits preceding the construction of two of the megalithic cists at Brahmagiri.39

In the upper Godavari valley one comes across a slightly variant chalcolithic culture. Its predominant ceramic industry, known from the type-site as

^{30.} H.D. Sankalia, B. Subbarao and S.B. Deo, Excavation at Maheshwar and Navidatoli 1952-53 (Poona and Baroda, 1958); and I.A. 1957-58, pp. 29-33; and 1958-59, pp. 30-31.

Conducted by N.R. Banerjee; I.A. 1955-56, pp. 11-19.

^{1955-56,} pp. 11-19.
32. M.G. Dikshit. Tripuri — 1952

⁽Nagpur, 1955). 33. Conducted by H.V. Trivedi: I.A 1959-60, pp. 24-25.

^{34.} Conducted by K.D. Bajpai: I.A. 1960-61, (in the press).

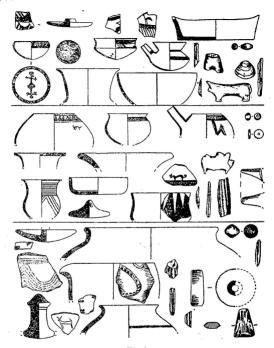
^{35.} Excavated by R.C. Agarwal: I.A. 1954-55, pp. 14-15; 1955-56, p. 11.

^{36.} Excavated by the present writer: I.A. 1959-60, pp. 41-46.

Excavated by B.K. Thapar: I.A.
 1954-55, p. 13.

Excavated by M.N. Deshpande: I.A. 1956-57, pp. 17-18.

^{39.} R.E.M. Wheeler, 'Brahmagiri and Chandravali 1947: megalithic and other cultures in Mysore State', Ancient India, no. 4 (1947-48). pp. 221-23.



the Jorwe Ware,40 is characterised by a matt, red surface painted over in black pigment, the more prominent shapes being the highly carinated bowl and vase with long tubular spout. The other

40. H.D. Sankalia and S.B. Deo. Report on the Excavations at Nasik and Jorwe 1950-51 (Poona, 1955).

noteworthy sites of this culture Nasik,41 Nevasa,42 Daimabad43 and

^{41.} ibid.

^{42.} H.D. Sankalia. B. Subbarao, S.B. Deo, Z.A. Ansari and S. Ehrhardt, History to Prehistory at Nevasa (Poona, 1960); I.A. 1954-55, pp. 5-9; 1959-60, pp. 25-28; and 1960-61, (in the press).

Chandoli,44 The evidence from Daimahad indicates that this variant chalcolithic culture may have been somewhat later than the chalcolithic culture typified at Navdatoli (fig. 2). Such an interrelationship is further supported by the position of the Jorwe Ware at Navdatoli itself, as also by a Carbon-14 date, viz. 3106 years Before Present C. 122, obtained for a charcoal piece from Nevasa. The other characteristic features of this culture include the occurrence of polished stone axes and the use of multiple urns for burying children, nay sometimes even adults. In one of the burials at Nevasa has been found a necklace of seventeen barrel-shaped beads strung with a thread, which according to the expert, Dr. A. N. Gulati, is made of white silk - indeed the earliest example of the use of that material noted so far in India.

To proceed further south. It may be recalled that the excavation at Brahmagiri.45 carried out in 1947 by Sir Mortimer Wheeler, had brought to light a clear-cut sequence of cultures, which has served all these years as an index in so far as this part of the country is concerned. From bottom upwards, the cultures were: I Polished Stone Axe Culture, with two sub-divisions, A and B. the earlier of which was characterised by the additional presence of a blackon-red to violet-on-buffish-red ware: II Megalithic Culture and III Andhra Culture. It was also noted that there was an overlap between I and II on the one hand and II and III on the other.

Excavations carried out in south India since 1947 have thrown further valuable light on the Polished Stone Axe Culture on the one hand and the Megalithic Culture on the other. In the first place, the work at Sanganakallu46 in District Bellary, Andhra Pradesh, showed that the Brahmagiri I A culture, with its black-on-red ware, was indeed not the hasal culture of the area. Instead, initially there was a 'true' Polished Stone Axe Culture into which, at a later stage, the black on red ware made its intrusion. Such a stratigraphical sequence is also vouchsafed by other excavations carried out since then, the more noteworthy amongst them being those at Piklihal47 and T. Narasipur,48 both in Mysore State. The work at Utnoor49 has thrown much welcome light on the life of the earlier (i.e. pre-blackon-red ware) people, while that at Maski⁵⁰ has contributed substantially to the picture of the later stage. A specimen of charcoal from the lower levels of the former site has given a date 4120 years Before Present C. 150, which clearly demonstrates that south India was occupied by 'true' Polished Stone Axe people in the last quarter of the third millennium B.C. and it was only afterwards that the black-on-red ware infil-

(1959), pp. 4-142.

^{43.} Excavated by M.N. Deshpande: I.A. 1958-59, pp. 15-18.

Excavated by H.D. Sankalia, S.B. Deo and others: I.A. 1960-61, (in the press).
 Wheeler, op. cit.

B. Subbarao, Stone Age Cultures of Bellary, Deccan College Dissertation Series, no. 7 (Poona, 1948).

^{47.} F.R. Allchin, Piklihal Excavations, Andhra Pradesh Government Archaeological Series (Hyderabad, 1960).

^{48.} Excavated by M. Seshadri: I.A. 1958-59, p. 33; 1959-60, p. 38.

^{49.} F.R. Allchin, op. cit; also by Sreenivasachar, I.A. 1958-59, p. 11.

^{50.} B.K. Thapar, 'A chalcolithic site of the southern Deccan', Ancient India, no. 13

tration took place. As a result of this infiltration, evidently from northern Deccan, south India seems to have received not only the black-on-red ware but also the 'crested ridge' technique of manufacturing blades. Conversely, the chalcolithic cultures of northern Deccan seem to have received in return the polished stone axes and, perhaps, the practice of urn-burials too.

On the megalithic side, much additional light has been thrown by the above-mentioned excavations at Maski and T. Narasipur and those carried out at Porkalam,51 District Trichur, Kerala, Sanur.52 Kunnattur53 and Amrithamangalam.54 District Chingleput, and Sengamedu,55 District South Arcot. all in Madras State; and Jadigenahalli,56 District Bangalore, Mysore, While Porkalam and Amrithamangalam have revealed further details about the urnburial type, Sanur, Kunnattur and Jadigenaballi have variously thrown light on cairn-circles, with or without a sarcophagus, and cists, dolmenoid or otherwise, with (pl. XII) or without a sarcophagus. At Kunnattur and Sengamedu have also been exposed habitational deposits, so often elusive at megalithic sites. A noteworthy point that emerges from these excavations is that the 'pitcircle', regarded by some scholars as a macerating pit may not indeed have been so: there is increasing evidence to suggest that it may have been just one of the many kinds of burials. The megalithic burials at Maski fall under the following four broad categories: (i) extended burial without lithic appendage; (ii) extended burial with lithic appendage: (iii) fractional burial without lithic appendage: and (iv) fractional burial with lithic appendage. Considering the facts that the megalithic burials are essentially fractional and have a lithic appendage, and that in earlier times extended burial usually without a lithic appendage, was the vogue, can we regard the Maski stage as transitional?

Prehistory also gets a fillip

INDEPENDENCE brought in its trail the Partition, and the latter deprived India of all sites of the typical Old Stone Age culture known as the 'Sohan.' This, however, did not dishearten Indian prehistorians who undertook a systematic survey of the sub-Himalayan terrains of Punjab. As a result, several sites of this culture have been discovered, the more prominent amongst them being Nalagarh, 57 Daulaptur, 58 Bilaspur, 59 Dehra60 and Guler.61 At the last-named site has

B.K. Thapar, 'Porkalam 1948',
 Ancient India, no. 8 (1952), pp. 3-16.
 N.R. Banerjee and K.V. Soundara-

rajan, 'Sanur 1950 and 1952', Ancient India, no. 15 (1959), pp. 4-42.

^{53.} Excavated by B. Saran: I.A. 1955-56, p. 23; and 1956-57. pp. 31-34.

^{54.} Excavated by N.R. Banerjee: I.A. 1954-55, pp. 20-22.

^{55.} N.R. Banerjee, 'Excavations at Sengamedu', March of India, June 1956, pp. 43-46.

^{56.} Excavated by M. Seshadri: I.A. 1956-57, pp. 34-35. (Full report has also been published.)

^{57.} D. Sen, 'Nalagarh palaeolithic culture', Man in India, XXXV no. 3 (July-Sept. 1955), pp. 176 ff. Olaf Prufer, The Prehistory of the Sirsa Valley, Panjab, India (1956).

^{58.} Explored by Y.D. Sharma: I.A. 1954-55, p. 58.

Explored by V.D. Krishnaswami.
 and 61. B.B. Lal, 'Palaeoliths from

the Beas and Banganga Valleys, Panjab', Ancient India, no. 12 (1956), pp. 58-92.

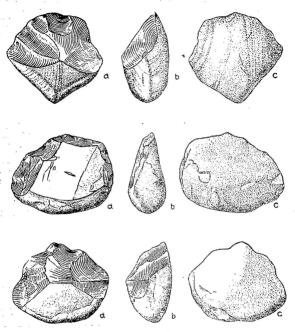
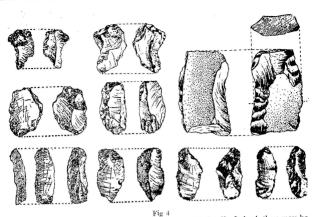


Fig. 3

also been noted a sequence of five terraces with the upper four of which can be associated the lithic implements. In connection with typology, a point that merits mention is that the tools are essentially unifacial (fig. 3), there being hardly any noteworthy example of the

bifacial handaxe and none whatever of the cleaver. As Guler is within hardly seventy kilometres of the glaciated regions of the Himalayas, it is planned to correlate the implementiferous terraces of the site with the Glacial and Interglacial epochs of the Pleistocene.



Another, and perhaps more noteworthy, contribution of the post-Independence period to the study of Indian prehistory is the discovery at a large number of sites⁶² of what are known as

62, H.D. Sankalia, 'Animal fessils and Palaeolithic Industries from the Pravara Basin at Nevasa, District Ahmadnagar', Ancient India, no. 12 (1956), pp. 35-52; H.D. Sankalia, B. Subbarao, S.B. Deo, Excavations at Maheshwar and Navdatoli (Poona and Baroda, 1958); B. Subbarao, The Personality of India (Baroda, 1958), pp. 62 ff; V.D. Krishnaswami, 'Progress in Prehistory', Ancient India, no. 9 (1953), pp. 63-64; S.C. Malik, Stone Age Industries of the Bombay and Satara Districts (Baroda, 1959); Bridget Allchin, 'The Indian Middle Stone Age: some new sites in central and southern India, and their implications', Uni. of London Inst. of Arch. Bull., no. 2 (1959), pp. 1-36. Other sites brought to light variously by R.V. Joshi, K.D. Banerji, M. Seshadri, D.P. Khatri and others are referred to in different numbers of I.A.

tools of Series II. Indeed, they may be regarded as representing the 'Middle Stone Age' in terms of the African terminology or the 'Upper Palaeolithic' in terms of the European, for typologically as well as stratigraphically they stand in between the handaxe-cleaver (Series I) complex on the one hand and microliths (Series III) on the other. Made usually on fine-grained stones, such as agate, chalcedony, jasper, etc., the Series II tools include points, blades, rarely burins, a large variety of scrapers, etc. (fig. 4). At Nevasa,63 on the bank of the Pravara, a tributary of the Godavari, in District Ahmadnagar, Maharashtra, their association with the fossil remains of the Bos namadicus definitely puts them within the Pleistocene, maybe, at

^{63.} H.D. Sankalia and others, From History to Prehistory at Nevasa (Poona, 1960), pp. 78 and 102.

the latest, in its last quarter. At Maheswar has been noted a clear-cut terracesequence which shows that the tools of Series II lie unconformably over those of Series I. A study of the Series II material in the neighbourhood of Nagpur has suggested that within this stuff itself there may have been a kind of evolution.⁶⁴

As regards microliths too, quite a lot has been done, particularly bearing on their antiquity, stratigraphic position, classification, etc.65 A survey of the Teri sites of south India has indicated that the main microlithic industry may be associable with a sea-level seven to eight metres higher than the present one. Thus, suggests Zeuner, the microliths may be placed around 4000 B.C. with the proviso that further geological

64. Explored by R.V. Joshi: I.A. 1959-60, pp. 31-33.

65. F.E. Zeuner and Bridget Allchin, 'The microlithic sites of Tinnevelly District, Madras State', Ancient India, no. 12 (1956). pp. 4 ff.; V.D. Krishnaswami and K.V. Soundararajan, 'The lithic tool-industries of the Singrauli basin', Ancient India, no. 7 (1951), p. 40 ff.; H.D. Sankalia, 'The microlithic industry of Langhnaj, Gujarat'. Jour. Res. Soc., XVIII, no. 4 (Oct. 1956), pp. 275-84; B. Subbarao. (Archaeological Explorations in the Mahi Valley', Jour. M.S. Uni. Baroda, I (1952), pp. 35 ff; M. Seshadri, The Stone-using Cultures of Prehistoric and Protohistoric Mysore (London, 1956); D.H. Gordon, 'The Stone industries of Holocene in India and Pakistan', Ancient India, no. 6 (1950), pp. 64-90; B.B. Lal, 'Birbhanpur, a Microlithic Site in the Damodar Valley. West Bengal', Ancient India, no. 14 (1958), pp. 4-48; (Dr.) B.B. Lal, 'The microlithic site of Birbhappur: a Geochronological Study'. Ancient India, nos. 16 and 17 (1960 and 1961) (in the press); for excavations at Adamgarh by R.V. Joshi and M.D. Khare see I.A. 1960-61. (in the press).

research may push them back into the Pleistocene'. A similarly high antiquity appears to be involved in the case of the microlithic industry encountered at Birbhanpur, District Burdwan, West Bengal, where it has been found in an early (penultimate) terrace of the Damodar, overlain by a metre thick deposit of sandy earth which has weathered in the course of time. As to typology, it appears that the earlier industries did not include typical geometric forms like the triangle and trapeze, which made their appearance only at a late stage when or whereafter pottery, though on a limited scale, also made its appearance. Langhnaj in Gujarat is a very good example of this second category.

Burzahom-Its unique position

Long back De Terra had brought to light at Burzahom, 66 about twenty-four kilometres north-west of Srinagar, a polished stone axe culture, about the antiquity and stratigraphic position of which, however, he had made certain enigmatic statements. As his excavation was, at best, of a trial nature and as observations by subsequent writers had only added to the mystery of the site, 67 a fresh excavation was started in 1960 to get a clear-cut picture of the culture-sequence and other details, 68

It has since been revealed that the earliest settlers at the site were some sort of 'pit-dwellers'. Cut into the

H.De Terra, 'Excavations at Burzahom', Miscellanea of the American Philosophical Sec. (1936).

D.H. Gordon referred to the occurrence of the N.B.P. Ware at the site; op. cit (1950), p. 80.

^{68.} Under the direction of T.N Khazanchi: I.A., 1960-61 (in the press).

upper Karewa bed, the pits vary from 13 metre to three metres in depth. On plan, they are roughly circular, but a noteworthy feature is that they have a narrow mouth, say from one to two metres in diameter, but go on widening as they go down, the lower portion thus ranging roughly from two to four metres in diameter. As the soil in which they are cut is very hard, the seemingly unusual tapering of the sides is indeed not dangerous. On the flat bottom of the pit have been encountered deposits signifying occupation. Some other noteworthy architectural features of the pits are the provision of one or more landing steps in deep pits and of niches in certain cases. The occurrence of post-holes on the periphery of the mouth in many examples points to existence of some kind of a roofing arrangement. inhabitants used polished stone axes, mace-heads, a variety of bone-tools including harpoons, needles, chisels, burnishers, etc. (pl. XIII), and a kind of burnished steel-grey ware, mostly hand-made and decorated with matimpressions at the base (pl. XIV).

The succeeding phase is characterised by structures of mud and mud-brick and by a burnished black ware, which, incidentally, is different from the Northern Black Polished Ware. Polished stone axes continued as in the preceding phase but bone-tools were used in a greater number.

Ascribable to the next higher phase are several large-sized vertical stones resembling the megalithic menhirs. The excavation, which is still underway, will, it is hoped, throw light on their purpose.

The last occupation which seems to be removed in point of time from the preceding phases, may, on the basis of the available evidence, be dated to the early centuries of the Christian era.

As to the dates of the earlier phases, nothing definite can be said at present. In fact no parallel material is known from any site in India. Thus, one guess would be as good or bad as another. For parallels, it appears, one has to look beyond the confines of India — maybe to Central Asia and northeastern Iran.69

Historical archaeology-not neglected

WHILE an attempt to illumine the Dark Age has no doubt been our primary concern during the past several years, historical archaeology has not been neglected as, perhaps, one might be carrying the impression. And, indeed, in this direction too, no mere routine work has been done, but significant contributions have been made. Thus, while many of the sites excavated in connection with the problems of the Dark Age had already yielded remains of the historical times as well, independent excavations were also carried out at several historical sites, the more noteworthy of them being: Jagatgram,70 District Dehra Dun, Uttar Pradesh;

^{69.} For example, a mat-impressed grey and bone-tools are available at Shah Tepe (T.J. Arne. Excavations at Shah Tepe, Iran. Stockholm, 1945), but as other associated industries at the two sites differ, much further investigation is necessary to say anything finally.

Excavated by T.N. Ramachandran:
 I.A. 1953-54, pp. 10-11.

Delhi, 71 Tamluk, 72 District Midnapur, and Chandraketugarh, 73 District 24-Parganas, both in West Bengal; Sisupalgarh, 74 District Puri, Jaugada, 75 District Ganjam, and Ratnagiri, 76 District Cuttack, all in Orissa; Baroda 77 and Amreli, 78 in Districts of the same names, and Devnimori, 79 District Subharkantha, all in Gujarat; Sirpur, 80 District Raipur, Madhya Pradesh; Ter, 81 District Osmanabad, Maharashtra; and Salihundam, 82 District Srikakulam, and Amaravati, 83 District Guntur, both in Andhra Pradesh.

71. Excavated by Y.D. Sharma: I.A. 1957-58, pp. 24-25; 1958-59. p. 25. Also excavated by the present writer: I.A. 1954-55, pp. 13-14.

72. Excavated by M.N. Deshpande: I.A. 1954-55, pp. 19-20.

· 73. Excavated by K.G. Goswami: I.A. 1956-57, pp. 29-31; 1957-58, pp. 55-56; 1958-59, pp. 55-56; 1959-60, pp. 50-52; and 1950-61 (in the press).

74. B.B. Lal, op. cit (January, 1949).

75. Excavated by Shrimati D. Mitra: I.A. 1956-57, pp. 30-31.

Excavated by Shrimati D. Mitra:
 I.A. 1957-58, pp. 39-41; 1958-59, pp. 33-36;
 1959-60, pp. 38-39; and 1960-61 (in the press).

 B. Subbarao, Baroda through the Ages (Baroda, 1953).

78. Excavated by S.R. Rao: report under publication.

79. Excavated by B. Subbarao and others: I.A. 1959-60, pp. 19-21; and 1960-61 (in the press).

Excavated by M.G. Dikshit: I.A.
 1954-55, pp. 24-26; and 1955-56, pp. 26-27.

Excavated by P.M. Joshi: I.A. 1957 pp. 23-24.

82. Excavated by R. Subrahmanyam: I.A. 1953-54, pp. 11-12.

83. Excavated by R. Subrahmanyam and Krishna Murty: I.A. 1958-59, p. 5. Located within a couple of miles from Kalsi, famous for the Asokan edicts, the site of Jagatgram has yielded evidence of as many as four horse sacrifices (asvamedhas) performed by a king called Silavarman in the third century A.D. The sacrificial altars, mostly in the form of an eagle (syena) with sprcad out wings, contain bricks bearing Sanskrit inscriptions to the above effect (pl. XV).

The excavations in and around Delhi are divisible into two parts, one relating to the early historical times and another to the medieval. The former, conducted on a very small scale, revealed that the area now bounded by the Purana Qila contains remains which go as far back as the Painted Grey Ware times. The latter excavations have thrown light on the structural activities associated with Lal Kot and Qila Rai Pithora, believed to have been built respectively by the Tomara king Anangapala and the Chahamana king Prithviraja II.

Known to literature as Tamralipti, famous as a trading-station as well as a seat of learning, Tamluk has yielded evidence of high antiquity. In the lowest levels have been found polished stone axes accompanied by an ill-fired pottery. The next higher levels yielded cast coins of copper and Mauryan-Sunga terracotta figurines. From the levels that followed has been recovered, in profuse quantity, the Rouletted Ware, the designs on which are known to have been produced in imitation of a Roman ware called the Arretine. Indeed, is not the location of Tamluk, on the mouth of the Rupnarayana (a distributary of the Ganga), not far from the Bay of Bengal, immensely suited for a sea-borne trade? The upper levels of the site have yielded fine specimens respectively of Kushan and Gupta terracottas (pl. XVI). After a break of occupation, came up sculptures of Pala and Sena periods.

About fifty-three kilometres northeast of Calcutta lies Chandraketugarh where excavations, carried out for the last five years, have brought to light remains dating from the Mauryan to post-Gupta times. Amongst the exposed structures, particular mention may be made of a large brick temple, there being, however, no definite evidence regarding the deity installed in it. Another noteworthy structure is a seven-metre deep pit lined with polished bricks in thirty-seven regular offsets (pl. XVII). The pottery included the Northern Black Polished Ware, in the lower levels, and the Rouletted Ware, in the upper. Amongst other finds mention may be made of punch-marked and cast copper coins, and terracotta plaques, moulds and sealings.

Amongst the early sites excavated in Orissa are Sisupalgarh and Jaugada. While the former is located within five kilometres of the famous rock (at Dhauli) bearing the edicts of Asoka. the latter includes a similar edict-bearing rock within its own precincts. Excavation at the former site revealed that it was occupied from circa fourth century B.C. to fourth century A.D. It was enclosed by a fortification wall forming a rough square. The wall had a mud core reinforced on either side with a burnt-brick revetment. Measuring a little over a kilometer in length, each side was pierced by two large gateways (pl. XVIII) and two smaller openings.

The main roads in the interior ran between the corresponding gates on the opposite sides, thus forming a grid pattern. Amongst the pottery-types, particular mention may be made of a knobbed ware and the Rouletted Ware. There is circumstantial evidence to suggest that the site may be identified with Tosali, referred to in the abovementioned Asokan edicts, and with Kalinganagara of Kharavela's inscription, occurring in a cave on the nearby Khandagiri-Udayagiri hills.

Jaugada more or less repeats the story of Sisupaigarh, the arms of the square fortifications, however, being somewhat smaller. Amongst the finds special mention may be made of a polished stone axe, from the lowest levels, and a large quantity of beads in an unfinished condition (from a middle level) indicating that they were manufactured locally.

Of the Buddhist establishments at Lalitgiri, Udayagiri and Ratnagiri, those at the last-named hill have been under excavation for the last four years. This large-scale work has indeed opened up a vast treasure of structures, sculptures, bronzes, inscriptions and other small finds ranging in time from the Gupta to the early medieval period. The inscriptions reveal that the Buddhist establishment bore the same name as does the modern place today. Amongst the structures particular mention may be made of two large-sized monasteries (pl. XIX), a large-sized and several small stupus and about halfa-dozen temples. The sculptures display a large variety of the Buddhist pantheon-Dhyani-Buddhas, Tara Avalokitesvara, Vasudhara. Manjusri, Shadakshari-Lekesvara, Jambhala, Vajrapani, Arya-Sarasvati, etc., and indicate that the Mahayana-Vajrayana development of the Buddhist pantheon took place, at least in this part of the country, somewhat earlier than is generally believed.

Excavations in and near Baroda revealed, apart from the underlying microlithic industry, an almost continuous occupation from the beginning of the Christian era to the sixteenth century. The earlier levels yielded, amongst other things, the Red Polished Ware, Kshatrapa coins, and a few clay seals in Graeco Roman style. The most noteworthy amongst the finds of the later levels, represented particularly in the neighbourhood of Akota, are excellent specimens of Jaina bronzes ascribable to the early medieval times.

Dating from circa first century B.C. to fourth century A.D., Amreli has yielded, besides the Red Polished Ware, Kshatrapa coins, etc., evidence of pit circles with post-cremation burials.

The excavation at Devnimori has brought to light a vihara, a stupa and an aspsidal temple ranging in date from circa A.D. 200 to 700. The sculptures of the Buddha, mostly in the dhyanamudra, are reminiscent of the Gandhara style. The site has yielded a large number of coins of the Kshatrapas and one of Bhatarka, the founder of the Maitraka dynasty of Valabhi.

At Sirpur, the general habitation area yielded evidence of three successive occupational periods, dating from circa fifth to eleventh century. In the 'religious centre' were encountered the remains of several monasteries, some of which yielded fine bronzes made by the

cire perdu technique. An interesting find from the site was a Chinese copper coin, circular in shape and, with a square hole at the centre, attributed to Kai Yuan (713-41), which shows that Chinese visitors were attracted to the centre.

Located on the bank of Terna, about twenty kilometres north-east of Osmanabad, Ter (ancient Tangara) yielded evidence of a continuous occupation from circa fourth century B.C. to fourth century A.D. Amongst the variegated finds from the site particular attention is drawn by terracotta figurines, some of which also show Roman influence, and fine ivory carvings.

The excavation at Salihundam has yielded inscriptions which refer to the site as Salipetaka (emporium of rice?), and to the hill containing the monastic establishments as Maha-ugapayyata.

Already well known for Buddhist remains, Amaravati was partly re-excavated to examine the plan of one of the stupas. Of it, the original drum, ayaka-platforms and pradakshinapath were brought to light. In slots in the urdhva path of the railing were discovered five crystal caskets of very fine workmanship (pl. XX). The excavation of the adjacent area revealed from, bottom upwards, the N.B.P., Rouletted and Celadon Wares, indicating that the site was occupied from circa third century B.C. to circa tenth century A.D.

Salvage operations in river-valley projects

As in other parts of the world, so also in India, a problem that often worries the administration is how to provide more food to the ever-increasing population. And, unless a country physiographically incapable producing more on its own soil, the obvious answer is: bring more and more area under cultivation, besides, of course, using improved methods of food-production. This necessitates the construction of dams and canals to provide irrigation facilities. And more often than not do these dams threaten ancient monuments and sites with submergence. Then the administration has to face the crucial question: should the ancient relics be allowed to stand in the way of the needs of the modern man, or should the dams be allowed to come up, the ancient relics being salvaged if and as far as possible? And while it may seem to be all right as a policy-statement that each case should be judged on its own merit, experience tells us that the judgment often, if not invariably, goes in favour of the modern man. Is it because it is the modern man who pleads both for himself as well for his ancient counterpart? Be that as it may, the effect is that the archaeologist has to work against time, money and skilled assistance to carry out salvage operations at such doomed sites.

In India many such operations have been, are being, and perhaps will have to be, carried out. The most noteworthy amongst them is the one involving the well-known Buddhist site of Nagarjunakonda.84 Situated on the right bank of the Krishna, it is to be sub-

merged, along with Yellesvaram on the opposite bank, under the waters of a eighty metre high dam which is coming up hardly seven kilometres downstream. The excavations, started in 1954 and completed only recently,85 have revealed that the Nagarjunakonda valley has been under occupation right from the Palaeolithic times.86 The tools comprise handaxes, ovates, cleavers. etc. The next lithic industry is characterised by flake-blades, scrapers, etc., reminiscent of what has been called Series II elsewhere. This is followed by a microlithic industry of the non-geometric type. The story then passes on to the Polished Stone Axe Culture yielding remains of regular settlements and burials. The site is indeed very rich in the tools of this culture, which include axes, adzes, fabricators, mace-heads, etc. Next in order come the megalithic burials of which a dozen examples, including cists and pit-circles, have been excavated. The pit-circles contain regularlyburied skeletons, thus confirming the evidence of Maski and Sanur that the nits were not meant for excavation.

Of the historical period, indeed vast and varied remains have been encount-

^{84.} A.H. Longhurst, The Buddhist remains of Nagarjunakonda, Madras Presidency, Mem. Arch. Surv. Ind., no. 54 (1938); T.N. Ramachandran, Nagarjunakonda 1938, Mem. Arch. Surv. Ind., no. 71 (1953).

^{85.} Excavated under the direction of R. Subrahmanyam, assisted by K.V. Soundararajan, K.K. Sinha, M.D. Khare, H. Sarkar, R. Singh, Abdul Waheed Khan, with general guidance, at a later stage, from T.N. Ramachandran: L.A. 1954-55, pp. 22-22; 1955-56, pp. 23-26; 1956-57, pp. 35-38; 1957-58, pp. 5-10; 1959-60, pp. 6-10; and 1960-61: (in the press).

K.V. Soundararajan, 'Studies in the Stone Age of Nagarjunakonda and its Neighbourhood', Ancient India, no. 14 (1959), pp. 49-113.

ered. Broadly, they can be classed under two heads: religious and secular. Under the former category are, one might almost say, innumerable stupas, chaituas, viharas and temples of the Buddhist faith and a few temples of the Brahmanical faith. Most of them are assignable to the reigns of the Ikshavaku kings (early centuries A.D.), which fact, incidentally, throws light on the religious attitude, if not beliefs, of the concerned kings. Amongst the secular, (which term may also include military) structures come four fortifications built in different areas from the Ikshavaku period down to the medieval times. Of these, the most centrally located one and enclosing an area about 900 x 600 metres is the citadel of the Ikshavakus, from the outstanding buildings within which was carried on the administration of ancient Vijavapuri. Amongst the other noteworthy structures particular mention may be made of: a stadium having the arenaspace of about ninety by seventy metres around which rose in a stepped fashion the seats, with a special pavilion on one side, evidently for the dignitaries; and a large-sized stepped and balustraded ahat, with a veneer of limestone slabs. on the bank of the Krishna (pl. XXI). Close to the river-side was also located a cremation-ground, presumably of the royal family, wherein two sculptures, one showing a lady lying in state and another showing a lady against a ladder as though jumping in a fire, were of interest. The latter might suggest that sati had been practised here.

Those engaged on the construction of the Nagarjunasagar Dam perhaps do not know that their ancestors, more than a millennium and a haif ago, had already laid out a system of canals in this area, one of which, measuring nine metres in width and two metres in depth, has been traced to a length of nearly three hundred metres.

The antiquities recovered from the site include a large number of fine sculptures and terracottas, relic caskets, jewellery, goldsmith's equipment including moulds, and coins variously of the Ikshavakus and Satavahanas besides two Roman aurei, one each of Tiberius (A.D. 16-37) and Faustina the Elder, motherin-law of Marcus Aurelius and queen of Antonius Pius, issued after A.D. 141. Also recovered was a large number of Sanskrit and Prakrit inscriptions, some of which lead to the revision of Ikshavaku chronology.

The Survey has not rested itself with the excavation only. Arrangements are well under way to set up a full-fledged site-museum on the top of a hillock which would be jutting out of the swirling waters of the dam. this hillock are also being re-erected some of the excavated monuments, particularly the ghat which would still continue to be washed by the river, though several metres above its present level. On another hill on the periphery have been re-erected a few other structures, maintaining, wherever necessary, the original ground-contours. In cases where the highly deteriorated condition of the bricks did not permit the transplantation of the monuments, large-sized models have been prepared, which will be on display in or in the vicinity of the above-mentioned museum.

The excavation at Yellesvaram, carried out by the Department of Archaeology, Government of Andhra Pradesh,87 has brought to light more or less the same sequence of cultures aencountered at Nagarjunakonda. In the area around the Yellesvaraswami temple have been unearthed several noteworthy structures including Viharas, chaitya-halls, etc. Not very far from there has been located a ghat, with a series of steps, leading down to the Krishna.

Proceeding northwards, the other areas where salvage operations have been or are being carried out are: the Tapti valley in District Dhulia, Maharashtra; the Chambal valley in District Mandasor, Madhya Pradesh; the Kasai (Kangsavati) valley in Districts Bankura and Purlia, West Bengal; and the Sutlej valley in District Bilaspur, Himachal Pradesh. The excavations at Devnimori also were taken up partly as a sequel to an irrigation-project on the Meshvo.

On the Tapti, a dam is being control of the Tapti, a dam is being control of the the thick will be submerged a stretch nearly forty kilometres in length. Consequently, intensive explorations, followed by excavations at two sites. Bahurupa and Savalda, have been carried out.88 While Bahurupa yielded the remains only of the chalcolithic period, similar to those found at Prakash, Savalda yielded later material also, which included the plain black-and-red ware as well as certain pottery-types usually

found in association with the Northern Black Polished Ware.

As a result of a dam on the Chambal an area measuring nearly seven hundred square kilometres will be submerged under water. In order to salvage ancient relics comprised within the area, large-scale explorations, including excavations at Awra and Manoti, have been carried out by the Department of Archaeology, Government of Madhya Prodoch 89 The explorations have brought to light not only palaeoliths, tools of Series II, microliths, chalcolithic material, etc., but also rock-shelters containing paintings. Executed in red or dark-red ochre and available in several superimposed layers, the paintings at a place called Chibbar-nala depict animals such as the sambhar, spotted deer, moneky, lizards, etc., men holding battle-axes, and voked carts (fig. 5). At a place called Mori the shelters number as many as thirty and contain paintings portraying pastoral and dancing scenes.

Taken together, the excavations at Awra and Manoti have revealed remains dating from the chalcolithic to the early historical times. The pottery from the earlier levels includes the black-on-red. white-painted black-and-red and black wares, while that from the following levels includes the N.B.P. Ware.,

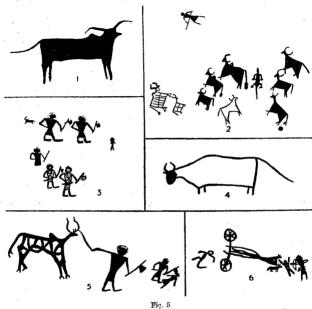
In the Kasai valley, where an area of about a hundred square kilometres is to go under water, the explorations carried out by the Survey90 have revealed

^{87.} Variously under the directions of P. Sreenivasachar and Abdul Waheed Khan: I.A. 1957-58, pp. 9-10; 1958-59, p. 12; and 1960-61 (in the press).

^{88.} Under the direction of R.V. Joshi, assisted by S.A. Sali, B.P. Bopardikar, S.P. Jain and K.M. Srivastava: I.A. 1958-59, pp. 22-25; and 1959-60, pp. 34-37.

^{89.} Variously under the directions of M.G. Dikshit and H.V. Trivedi, assisted by V.S. Wakankar: *I.A.* 1957-58, pp. 26-30; 1958-59, pp. 27-29; and 1959-60, pp. 22-25.

Under the direction of V.D. Krishnaswami, assisted by K.M. Srivastava and S.P. Jain: I.A. 1959-60, pp. 48-50.



article.1

sites bearing variously palaeoliths, tools of Series II, microliths polished stone axes, besides historical remains. The polished stone axes, with oblong crosssection, are characteristically east Indian in form. The historical remains include, besides habitational areas, temples ascribable to the twelfth-thirteenth centuries.

Explorations of the doomed areas in the Sutlej valley, the first part of which has just been completed by the Survey,91 have revealed, amongst other things of importance, palaeoliths of the typical Sohan industry.

91. Under the direction of V.D. Krishnaswami, assisted by K.M. Srivastava and S.P. Jain.

The author wishes to concerned excavators for the photographs and line-drawings accompanying this Thus is being fought the undeclared battle between the moderns and the ancients.,

In conclusion

The foregoing survey, though hurried and sketchy, should, it is felt, be sufficient to convey to the reader a reasonable idea of the efforts that have gone in since Independence to unravel the country's past. All concerned, i.e. the Survey, State Department of Archaeology and Universities and Research Institutes, are anxious to do, and perhaps have done, their best in discharging this rather urgent and, may we call it, sacred duty. Indeed, one cannot help quoting the renowned archaeologist Sir Mortimer Wheeler who, in 1958, stated: Today, no part of the world is better served in archaeological matters than is the Republic of India'. But this should, in no case, give rise to complacency, for what has been done is but a fraction of what still remains to be done. And in this connection there are three things that stand supreme in the mind of the present writer. If they involve any selfcriticism, let it indeed be taken in the proper light, for self-awareness is the only acknowledged path to self-enlightenment.

In the first place, let it be stated, and admitted too, that while many an excavation has been carried out with great preservance and skill, producing important results, its reporting has lagged far behind. This should make us pause for a moment and ponder over the consequences of unpublished excavations. Thus, better late than never' should be our motto for the next few years during which an all-out effort should be made to clear up the arrears.

The second point relates to planning. More vertical than horizontal excavations have been carried out since Independence. While such a state of affairs is not decried in the least, for vertical excavations are necessary to build up a culture-sequence, time has come when each one of the cultures identified so far is studied in full detail.

This can be done only when large-scale horizontal excavations are carried out at selected sites spread over a period of at least three or four years. Further, if in certain cases it becomes necessary to remove the structures, etc. of the upper levels to get a clearer picture of the lower, primarily for which the site has been taken up, let it be agreed to that we may do so, provided, of course, comprehensive recording in all possible ways is done of what is desired to be removed.

The last point that the writer would like to emphasise is the need to study the Indian material in its wider context. To be more precise, out of the material unearthed since Independence. Painted Grey Ware Culture associable with the Arvans, the central Indian Chalcolithic Culture as represented at Navdatoli, the exotic seals and pottery from Lothal and last but not least the bone-tools from Burzahom have all to be studied in the light of their counterparts in western Asia, Likewise, there are quite a few items, e.g. pebble tools, polished stone axes with oblong sections. etc., indicating contacts with eastern Asia. It is indeed high time that Indian scholars, individually or in teams, were sent out to respective areas to make a first-hand, detailed study of the concerned material

EPIGRAPHICAL RESEARCH

B. Ch. Chhabra

Epigraphy is the pride of archaeology. The Archaeological Survey of India, of which we are celebrating the hundredth anniversary, it may be recalled, owes its origin to epigraphy. It is a highly specialised subject, and hence its votaries are few and far between. In fact, it is so little known outside the circle of specialists that an average educated individual frankly admits ignorance even of the meaning of the term 'epigraphy'.

EPIGRAPHY simply means study of old inscriptions. An epigraph is a writing engraved upon a substance—be it stone, metal, wood, clay, shell or the like. Though engraving is the chief characteristic of an epigraph, there are exceptions to this rule where a writing in ink is also accepted as an epigraph. A person who studies—deciphers and interprets—epigraphs is called an epigraphist. The Epigraphy Branch of the Archaeological Survey of India is manned by such specialists....

Manuscripts, however old, are as a rule not included in epigraphy. Museums and libraries possess various types of manuscripts, paper, palm-leaf, birchand what not. The writing on palm-leaf manuscripts is, in many cases, engraved or incised being written in ink, and yet they are not called epigraphs. distinction between cript and an epigraph is that the former can be a copy of a copy of a copy of the original while the latter is the original itself. And that is why a wooden tablet, a potsherd or a copper-plate with a writing in ink, dug out from an ancient site by the spade of the archaeologist, passes as an epigraph, whereas a palmyra-leaf with a writing incised on it is usually considered a manuscript and not an epigraph. An epigraphist has often to deal with manuscripts as well, especially when they form part of excavated antiquities.

The spade of the archaeologist turns out coins, medals and seals, too.

Inscriptions on them are termed legends. Their study is equally a part of epigraphical research, though strictly speaking each of the catagories is differently designated. The study of coins, is known as numismatics or numismatology, while that of seals is called sigillography. A distinction is made, for the sake of convenience, between a seal and a sealing. The former denotes the original seal, mould or matrix on which the legend or design is engraved in the negative, whereas the latter signifies the impression thereof, on clay, wax or the like. It may be observed that many an ancient site in India has yielded hundreds of clay (baked as well as sundried) sealings. The number of seals so discovered is, as is but natural, comparatively small, though it presents a greater variety, some of them being of ivory. steatite, semi-precious stones, and even terracotta, besides those of metal, precious and otherwise. What epigraphy involves EPIGRAPHY or study of old inscrip-

tions demands a two-fold qualification of its votary: ability to decipher the script and ability to interpret the language. These are two distinct things: palaeography and linguistics. The former is concerned with old writings alone, without any reference to the contents. It often happens that one is able to decipher or transcribe a document, and yet is unable to understand the contents thereof. We are familiar with the Roman script, but that does not mean that we can understand French, Italian, Spanish and similar other languages that use the Roman script, unless we have made a special study of the languages concerned. As far as old inscriptions in India are concerned, they employ numerous scripts and numerous languages, which make the task of the student both difficult and complicated. In between linguistics and palaeography comes orthography, which is concerned mainly with peculiarities of spellings. For grammatical reasons or owing to an individual's fancy, one and the same word is spelt differently as, for instance, Ayyar, Aiyar, Iver. This phenomenon is frequently met with in old inscriptions of India.

Diplomatic (as a noun and not as an adjective) is another branch of study that is involved in epigraphical research. It is concerned with the styles and modes of the wording of certain types of documents such as charters, titledeeds and the like.

Calligraphy means beautiful writing. This refers to the skill of the scribe and the engraver and is more in evidence in Arabic and Persian inscriptions where the letters are not incised but raised.

Epigraphy in India

Epigraphy enjoys a unique position in India. Nowhere else has it served history so well as it has done here. It constitutes the most substantial part of all the varied data afforded by archaeology as sources of history. It is no exaggeration to say that without epigraphy our knowledge of the ancient history of India would have been next to nothing. Happily, India has inherited a vast legacy of epigraphical material. as if under the dictates of the law of compensation; for, she can otherwise boast of no regular archives of historical records, annals or chronicles, relating to the early period. The number of old inscriptions so far discovered runs literally into thousands, and it is gratifying that this wealth is being augmented by hundreds of fresh discoveries every year. Besides, the numerous ancient sites that await excavation always hold out a great promise.

Information imparted by an inscription is generally accepted as more trustworthy than any other. It seldom needs corroboration. On the contrary, it often authenticates a literary text, lends authority to a tradition or confirms an inference.

Outside India hundreds of early Sanskrit inscriptions are found in the lands and islands of the south-east Asia, where they have been studied and published mainly by French and Dutch scholars

Ancient Indian Scripts

ANCIENT inscriptions would have remained a sealed book to us but for the tremendous efforts on the part of the pioneers in the field. Special credit is due to James Prinsep who did marvellous work in deciphering the edicts of Asoka, thereby supplying the key to the forgotten Brahmi, the earliest historical script of India. The subsequent researches proved that all the scripts prevalent in India, such as Devanagari, Gujarati, Bengali, Oriya, Telugu, Tamil, Kanarese, Malayalam, etc., have sprung from Brahmi. Not only that, the scripts used in Tibet, Burma, Indo-China, Indonesia, Ceylon and other regions surrounding India are derived from the same Brahmi. The intermediatory stages in the development of Brahmi, in different times and different climes. have been demonstrated through the wide range of inscriptions at our disposal.

It may also be observed that the two north-western versions of Asoka's rock-edicts employ Kharoshthi characters of Semitic origin. Unlike Brahmi and its derivatives, Kharoshthi runs from right to left. Its use was restricted to the northern regions including Chinese Turkistan. It altogether disappeared from India by the fifth century, without leaving a descendant behind.

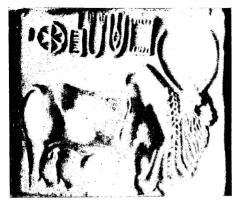
Muslim inscriptions in India that are found equally in good numbers usually employ Arabic and Persian scripts which, like Kharoshthi, run from right to left.

Languages of Indian Inscriptions

It is noteworthy that considering the remote antiquity of the Vedas and subsequent Sanskrit literature, the earliest inscriptions so far discovered are couched in Prakrit Later on Sanskrit dominates the field and still later provincial dialects as well as Arabic and Persian also make their appearance. The number of Portuguese, Dutch, French, and English inscriptions that are also found on Indian soil is negligible.

Some Sanskrit inscriptions are composed entirely in verse, some in prose and verse mixed, and others only in prose. The style ranges from simple to the highly ornate. In fact, certain inscriptions possess real poetic merit and can easily range among the best of literary productions. Many inscriptions contain peculiar terms and expressions that are linguistically as interesting as they are valuable for an understanding of administrative systems that prevailed in different parts of India in ancient days.

ANYTHING like a review of the contents being beyond the pale of this



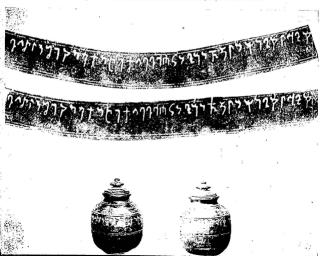
Enlargement of a Mohenjo-daro seal, defying decipherment. ± 2000 B.C.

A typical Harappan seal from Kalibangan, Rajasthan, defying decipherment. Right: the original steatite seal. Middle: the back of the seal. Left: the impression on clay. <u>1</u>2000 B.C.



Remmodel pillar-interption of Asoka Specimen of Asoka Brahmi inscriptions of about 250 B.C. It is engraved on a stone pillar near the shrine of Rummindel in the Nepalese Itauri. It records that Emper Asoka, after the twentieth year of the reign, without the Welligs of the reign, without the Welligs of the reign, white the Welligs of the reign without the Interface of the Interf

Specimen'of Kharoshthi inscriptions of about A.D. 200. It is engraved round the body of a some vase. It records the erection of a Buddhist stupa by two brothers, Sihila and Siharakshita byfiname. The vase was found near Taxila and is now kept in the Laborer Museum,



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Mehrauli (near Delhi) iron-pillar inscription in Sanskrit of about A.D. 400. It records the erection of the pillar by a king named Chandra in honour of the god Vishnu on a hill called Vishnupada

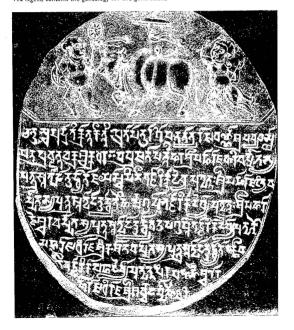
Chiaruton rock-instription of King Purnavarman. On a huge boulder in the stream at Chiaruton in West Java are engraved a pair of human foot-prints, a spider-shaped design in front of each, a line of ornamental inscription possibly containing the king's name, and a four-line Sanskrit inscription in Pallava-Grantha script (derived from Brahm) of about A.D. 400. This Jast constitutes a stanza and states: "The pair of feet is of the mighty king, the illustrious Purnavarman, the lord of the city of Taruma."

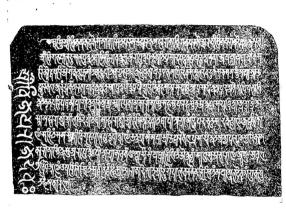




Copper-plate, engraved on both sides. Records a land grant by one Maharaja Lakshmana of Jayapura. From Pali, Allahabad District $\frac{1}{2\pi}$ A.D. 500

Impression of an elaborate copper seal of the Maukhari–King–Sarva-varman \pm A.D. 600. The legend contains the genealogy for five generations





Specimen of early Nagari inscription: on a copper plate. Records a land grant by King Vijayarajadeva of Orissa in about A.D. 1200. The exact find spot of the plate is not known. It is now kept at the India Office in London. Language incorrect Sanskrit influenced by Prakrit, Mark the calligraphy



Specimen of a Sarada inscription: Records the construction of a tank by one Vanhadaka. Dated Laukika Samwat 538æ A.D. 1461. Letters here are not incised but raised, as is usual in Arabic and Persian inscriptions. The original Stone bearing this Sanskrit inscription is said to have been found in Hazara District and is now kept in the Peshawar Museum.



Chittorgarh-part of Rana Khumba's palace before and after repairs



article, the following barest outline may convey some idea of the diverse nature of our epigraphical wealth. The place of honour naturally goes to the world famous seals of Harappa and Moheniodarn now in West Pakistan. Similar antiquities have in recent years been discovered also at certain sites lying in the east and south of the Indus Valley, such as Rupar in Punjab, Lothal in Gujarat and Kalibangan in Rajasthan. The short inscriptions or legends appearing on these unique seals or amulets still remain an enigma in spite of persistent attempts at unravelling their mystery. The most comprehensive analysis of them is perhaps that by G.R. Hunter (Script of Harappa Mohenio-daro and its Connection with Other Scripts, London, 1934). He calls the script Proto-Indian and holds it to he the fountain-head of Brahmi.

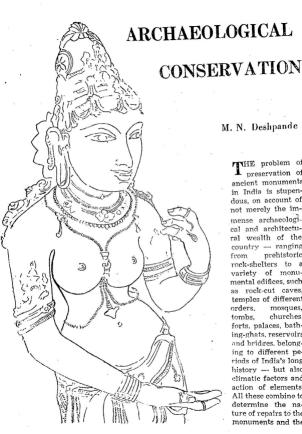
Decipherable epigraphy practically begins with a series of inscriptions, in Brahmi and Kharoshthi, of the Mauryan emperor Asoka. His known inscriptions. totalling nearly two hundred, are spread all over the country. Their contents reveal to us the emperor's solicitude for the moral well-being of his subjects and the charitable deeds done by him for both men and animals. The most outstanding of his minor edicts is the pillar inscription at Rummindei in the Nepalese tarai which settles the exact location of the Buddha's birth-place, as the inscription expressly states that here the blessed one was born'. The Maurya dynasty was followed by many other roval houses, the existence of some of which is known only from the stone inscriptions left by them in various parts of the country. The inscriptions

of dynasties like the Maghas and Nalas and the kings of Mekala, etc., which were known only from the Puranas, adment to our knowledge of the history of the period in which they held sway. Of the mighty imperial powers like the Guptas, the Vakatakas, the Pallavas, the Cholas, etc., we likewise know much more from their inscriptions.

Much information about the religious, social, cultural, economic and administrative matters is gleaned from these old inscriptions. Besides, they afford valuable geographical data not available elsewhere.

Many of the inscriptions bear precise dates from which we learn that several eras were current in ancient India such as, Vikrama, Saka, Gupta, Kalachuri, Ganga, Harsha, Laukika and so forth

The contribution made by the epigraphical researches in India during the past hundred odd years fills one with a sense of pride and satisfaction. It is a record of world scholarship working in unison for the cause of Indian history dating from the remote past. As a result of sustained efforts and devoted labour on the part of research workers in the field, who, by the way, count among themselves many a savant of international repute, much has been retrieved from oblivion, revealing light has been thrown on many an obscure corner, and glorious chapters, one after another, have been added to the history as it is being reconstructed. It is indeed very difficult to form a correct estimate of the extent to which history, or rather historiography, in India has been benefited by epigraphy. It is simply immense!



M. N. Deshpande

THE problem of preservation of ancient monuments in India is stupendous, on account of not merely the immense archaeological and architectural wealth of the country - ranging from prehistoric rock-shelters to a variety of monumental edifices, such as rock-cut caves, temples of different orders, mosques, tombs. churches. forts, palaces, bathing-ghats, reservoirs and bridges, belonging to different periods of India's long history - but also climatic factors and action of elements. All these combine to determine the nature of repairs to the

monuments and the

frequency with which they have to be attended to. It is, indeed, gratifying to note that the Archaeological Survey of India has, as a result of experience of over a century, formulated a set of principles and devised an organisational set-up to cope with this gigantic task. The main purpose of this article is to expound, with suitable but limited examples, the principles adopted by the Survey in the conservation of monuments so as to bring out the factors which matter in archaeological conservation.

In European countries, where historic monuments like cathedrals and churches suffered untold damage in the last two World Wars, reconstruction. verging on wholesale restoration of monuments, has been undertaken; the principle behind has been to save the authentic remains of the original edifice and to restore it as closely as possible. Somewhat contrary to this, the Archaeological Survey of India has been, generally speaking, following a policy of preserving the ancient edifice in as nearly the same condition as it was when it was handed down to its care. without undertaking any restoration. unless it is absolutely necessary for the structural stability of the monument as a whole. Aesthetic considerations do also sometimes necessitate the reconstruction of missing parts of the monument, but the guilding principle in this regard is the preservation of the ancient fabric of the monument with the minimum of restoration. As an example, the repairs executed in the year 1957-58 to the three-storeved structure of Rana Kumbha's palace-complex at Chitorgarh may be cited. Here, half of the dome over the rooms had collapsed, the sur-

viving parts were dangerously overhanging with the decay of wooden heams and lintels and the side-walls were supportless. Instead of taking recourse to a complete restoration (which was easy), thereby substituting a sixteenth-century building by a twentiethcentury one (even if built on ancient lines), the Survey chose to preserve scrupulously the extant portions. Thus, the measures of conservation consisted of the insertion of concealed reinforced cement-concrete rings at the two floorlevels of the side-room, tied with vertical nillars of the same material, also concealed introduced at the four corners of the main room and the verandah. The longitudinal walls were strengthened by a reinforced-concrete beam in the sidewalls, tied with the beam provided in the returning wall. Only the fallen portion of the dome was rebuilt, the dome being thus restored to its original shape.

To illustrate the point further, the restoration of the portion of the mandapa in front of Cave 15 at Ellora may be examined. Here, an important eighth century inscribed record of Dantidurga, a king of the Rashtrakuta dynasty, carved on the outer face of the wall of the western porch, had been exposed to the elements for years due to the fall of the roof and one of the supporting pillars and was, as a result, getting progressively obliterated. Nothing short of complete restoration of the roof would stop this: the roof of the porch was therefore reconstructed in reinforced cement-concrete in such a manner that the new work could hardly be distinguished from the old, both in point of texture and colour, except for a faint incised line specially carved to indicate the reconstructed area. The reconstruction here

was dictated by the requirements of the inscribed record and was not merely the restoration of the missing part for its own sake.

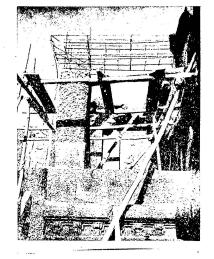
It will thus be seen that structural stability of the monument is the primary concern of the Survey; to achieve this, the minimum reconstruction of missing parts is permissible nay, sometimes imperative.

A factor of overriding importance is the aesthetic consideration involved in repairs to an ancient monument. Aesthetic consideration, some may say, is subjective and is therefore bound to vary from person to person. This, however, is not true. An ancient monument signifies the achievement of a particular age. and is the product of the creative urge of the people of the time and thus bears the indelible stamp of the age in which it was constructed. If the conservator understands the monument as a whole the period and the architectural style it belongs to, the nature of its buildingmaterials, the structural aspects and the reasons of its decay, he can confidently plan and execute its repairs and will at the end, be surprised to find that the aesthetic consideration has already been taken care of without any special effort on his part and that the repairs and reconstruction (if at all resorted to) is in complete harmony with the character of the monument. Conversely, no repair to an ancient monument can be properly planned without a complete knowledge of the monument itself. That is why the conservation of monuments cannot be left to civil engineers and practising architects

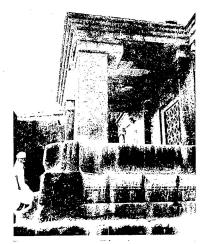
We may, therefore, formulate the maxim that the solution of the problem

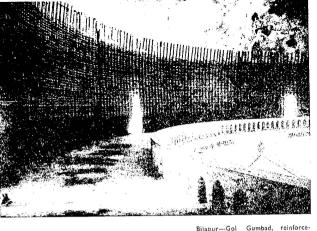
of conservation of a monument inherently lies in the complete understanding of the monument itself—in its historical, architectural and structural aspects.

To bring home the truth of this generalisation, we may examine the special repairs carried out to the Gol Gumbad in the Deccan, a seventeenth century monument famous for its acoustic properties. The extrados of the dome surmounting its whispering gallery had developed a number of cracks and natches of plaster from the inner side of the dome showed marks of watness It was feared that this would greatly interfere with the acoustic properties of the monument. In 1937 the exterior of the dome was, therefore, rendered watertight by a shell of gunite. A further development in the dome proved to be of great concern to the Survey: the wet patches of plaster soon dried up with the guniting of the exterior and having lost hold with the brick-core began to fall off; wide transverse cracks also appeared in the brick-shell. This unexpected development, which interfered with the acoustic properties and the structural stability of the monument. called for immediate attention. The retention of the acoustic properties largely depended on the condition of the intrados of the dome. It was, therefore, decided to institute enquiries into whether the whispering properties of the dome, which constitute its chief attraction, would in any way be adversely affected if the intrados of the dome was to be stripped off all plaster and minited all over to stabilise it. The problem was discussed in great detail. There was a consensus on the necessity of replastering of the dome for the stability of the structure and at the same

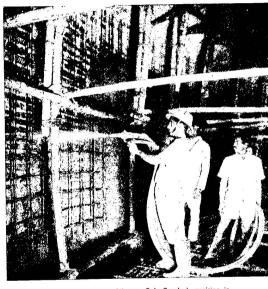


Ellora - Cave 15, porch in front of mandapa during and after repairs



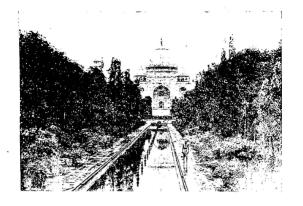


Bijapur—Gol Gumbad, reinforce-ment fixed against the intrados

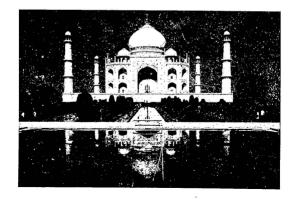


Bijapur - Gol Gumbad, guniting in progress





Agra-Taj Mahal in 1892 and 1961



time, the retention of its acoustic properties. It was, therefore, decided to provide a four and a half inch thick reinforced gunite shell below and against the intrados of the dome resting on a reinforced circular beam at the base and to double the reinforcement at the base to a height of two feet. The reinforcement was dovetailed with the brick-core by means of dowels at three feet centres either way, grouted in the masonry of the dome. In actual execution, stainless steel dowels were used with a view to eliminating the risk of rusting and consequent damage. The gunite was composed of one part of portland cement and three and one-half parts of sand: the standard gunite practice was followed in all the operations. The surface of the gunite was thereafter covered with fresh plaster, quite smooth and uniform. following the contour and colour of the original dome. The work lasted from March 1949 to July 1951, and it is to the credit of the Survey that the monument, famous for its architectural peculiarities and acoustic properties, was thoroughly repaired and the efficacy of the repairs established. Dr. Tawde, of the Institute of Science, Bombay, who recorded the acoustic properties of the dome after the completion of its repairs, observed that the maximum number of distinct echoes heard had been found to be twelve, thus giving a better multiple-echo effect than that recorded by earlier investigators; the other aspects of the acoustics, such as the whispering-gallery effect and the reverberation time had also shown improvement. All this has to be attributed 'to the improvement brought about by repairs to the intrados.

A point which may be brought out

in this connection is the care one has to take in the choice of materials used in the repairs. This is of as equal importance as the investigation of the properties of materials used in the original construction. The material to be used in renairs to monuments should be such that no adverse physical or chemical effect is brought forth. Iron pins and dowels were freely used in many ancient buildings for binding masonry, but, with the passage of time, the rusting of iron and its consequent expansion have caused fractures in the masonry, thus weakening the structural stability of the monument. While using similar medium for dovetailing parts of masonry, care has to be taken to see that material which is free from such disastrous consequences is alone introduced The same is true of many patent compounds manufactured and recommended for the treatment of leaky roofs, strengthening of roof-concrete, etc. These compounds have first to be tested in the laboratory for their components and effects before they can be used on a monument

A major problem that the conservator has to fight against in most parts of India is the vegetation taking root in the core of the monument. Many a monument has perished in the past as a result of negligence in the eradication of vegetation.

The combat against the elements is sometimes not very simple. The Sun Temple at Konarak and the Shore Temple at Mahabalipuram, both lying on the shore of the Bay of Bengal, presented problems of colossal magnitude which had to be, and have been, faced in individual ways. The sea-breeze blowing with considerable velocity had filled the entire compound of the Sun Temple at

which covered a part of its carved plinth. The action of the breeze had to be fought with imagination and, side by side with the physical removal of sand from the compound, the Survey had to arrange for the planting of a thick belt of casuarina trees all round the monument as a shield against the constant flow of sand into the compound. Other problems, like the solidifying of the masonry, removal of sea-salt damaging the sculptures on the monument, etc., had also to be tackled with natience and ingenuity. Pressure-grouting with cement mixed with ironite as waterproofing-material has been very extensively undertaken; the process is still continuing. Suitable chemicals have to he used to clean the surface of the injurious effect of salts and to make it impervious. The Shore Temple at Mahabalipuram was faced with utter extinction sea-waves constantly battering bv against it round the clock. This was counteracted by the construction of a grovne-wall, which now bears the brunt of the waves. Yet another aspect of conservation which needs attention is the scientific

Konarak with heaps of wind-borne sand

Yet another aspect of conservation which needs attention is the scientific investigation into the causes of disintegration of building-materials and the devising of means for arresting such decay. For this and other allied purposes, the Survey maintains a specialised Chemistry Branch, which has also to take care of the artistic treasures of the country, like paintings, the problem of cleaning and preservation of which has to be tackled with the utmost care and with an intimate scientific knowledge of their

grounds and pigments and of factors leading to their deterioration. The removal of disfiguring and corrosive vegetation, such as algae, of soot and of other accretions from monuments and the subsequent preservation of treated surfaces requires skilful experimentation and evolution of suitable solvents, detergents and preservatives.

The upkeep of the monument is not over with structural and chemical conservation. The ancient setting of a monument has to be visualised and appropriate conditions created for its proper appreciation. The laying of a garden (where one existed in the past) around a monument is a part of conservation. This task again has to be done with great care, so that the new lay-out conforms to the original design of the garden. The great Taj Mahal would not annear half as beautiful as it looks today if it were to be shorn of the beautiful Mughul garden laid around it. Even if no garden originally existed, one can be planned and laid out imaginatively in harmony with the character of the monument.

To preserve the ancient setting of a monument is an important factor which the town-planner should bear in mind and the conservator has often to fight for. The construction of modern buildings in the close vicinity of monuments, to meet the ever-increasing requirements of a growing nation, mars the aesthetics of monuments. In this regard, the conservator has to exercise a constant vigilance in the interest of the monument and thereby not unoften incur the displeasure of other interests.

ARCHAEOLOGICAL TRAINING

V. D. Krishnaswami

A RCHAEOLOGY is a discipline which studies antiquities as a means of reconstructing the past, provided that actions of the ancient man produced concrete results and left recognisable material traces. The ancient man has left his record variously through a span of five hundred thousand years, such as tools and implements, art and architecture, burials, monuments and earthwork, and all kinds of written records-all much beyond the conception of a historian. These material remains are studied by the archaeologist with the help of geology, palaeontology, physical anthropology, etc., and consequently a complete record of human activity is brought out and correct interpretations are deduced. Archaeology is thus a science having many-sided interests: of late, due to its special requirements, it has become a highly technical science, always endeavouring to achieve more of precision in interpretation, and the historian is drawing upon archaeology more

and more to help him write the story of human progress down the centuries. Thus, archaeology has become a recognised, distinctive branch of learning, with a body of techniques, a great accumulation of facts and a new set of interpretations of man's earliest history. An archaeologist, then, is not merely an antiquarian but a person with a scientific bent of mind trained specially for his job both in a university and in the field, and he develops many new techniques and gains new experiences as he goes on.

IN INDIA

Here we can briefly review the property of the past one hundred years. The year 1861 is a distinguished land-mark in the annals of Indian archaeology, as it witnessed the establishment of the Archaeological Survey of India, which has since then been the mainstay of all archaeological work in the country. From humble beginnings and after witnessing many a difficult day, it has

emerged as the biggest Governmental organisation relating to archaeology in the world, having in it well-trained specialists in each branch of archaeoance of training. Alexander Cunningham, the first Archaeological Surveyor (1861), though the pioneer in exploration, was a remarkable amateur. Burgess



logy. But in the formative stages, when the aims and methods of the Survey were in a nebulous stage, hardly any attention could be devoted to the importwho succeeded him in 1885, laid great emphasis on art and architecture. To him 'archaeology was but the history of art' and to this one end he subordinated

the remarkable and careful architectural Survey work he carried out. He found hardly any time to take much active interest in excavation. But, even though he was not conversant with the scientific methods available in his time, he was clear-sighted enough to insist on a professional control of excavations and to press for official measures to illegalise any digging except by the Survey. Burgess laid special emphasis on enlisting Indian talents in the discovery and translation of inscriptions and training them up in epigraphical research. He placed the Epigraphical Section of the Survey on a firm footing. The appointment of John Marshall

in 1902 as Director General was itself a recognition of the importance of 'a trained explorer combining archaeological knowledge with engineering skill' to organise and guide the Survey, Under him archaeological activities made tremendous progress, particularly in the spheres of excavation and conservation. He had great insight into the problems of preservation of monuments under Indian conditions and laid down the principles and methods of conservation in his Conservation Manual. Under him, the Survey maintained scholarships, all the holders of which later on established themselves as reputed archaeologists. But, as time passed, his methods of excavation fell far behind the international standard and archaeological training

was still in its rudimentary stage.

After his retirement, all did not go
well with the Survey, so that the Government of India decided, in 1937, to
invite a foreign expert, Sir Leonard
Woolley, to report on matters relating to
future excavations and allied matters.

observed that he saw the 'evidence of the work having been done in an amateur fashion by men anxious to do well but not sufficiently trained and experienced.' He felt that greater incentive should be given to encourage foreign and Indian institutions to take part in excavations.

In 1944, Dr. R.E. Mortimer Wheeler

In his report, Sir Leonard Woolley

was recalled from war-service and appointed Director General to bring about all-round improvement. gave a great fillip to the archaeological training in India. From the very beginning. Wheeler attached great importance to practical training. He realised that mere theoretical knowledge in history and language of the university graduates could hardly make a practical archaeologist. As he put it, 'a knowledge of Persian will not keep Tai Mahal from falling down, a knowledge of Sanskrit will not restore Chola paintings of the Great Temple of Tanjore.' Under him, the Survey organised training-schools in archaeological technique in the north at Taxila, and in the south at Arikamedu, besides minor schools at other places where he excavated. There was a

then kept up the practice, if on a restricted scale.

Wheeler also held refresher-courses in conservation. This amply demonstrated both the demand for and the utility of the Departmental training-courses. But, he realised, as also many of the members of the Central Advisory Board of Archaeology, which had come into being in 1945, that the time had come

good response and a large number of

students and attaches of Indian universities, museums and other organisa-

tions attended. The Survey has since

when this ad hoc training was organized on a permanent footing and administered by carefully-selected personnel of the Survey. He suggested that the training should be designed for three classes of trainees:

Young officers and technical subordinates; senior officers of the Survey (refresher-courses); selected graduates from the universities, who desired to take archaeology as their profession or supplement their historical teaching and research by some first-hand knowledge of archaeological method and material.

Arising out of the Director General of Archaeology's report, the Standing Committee in 1947 recommended to the Central Advisory Board of Archaeology that the Board might represent to the Government the need for the immediate establishment of a permanent Training Branch in the Archaeological Survey of India. From time to time, the members of the Central Advisory Board pleaded that the Survey should have a separate training school as 'universities were not complete from archaeological point of view'. Wheeler himself wrote in 1947: 'At present Indian universities do not provide systematic training in archaeology on an adequate scale and the onus of this essential task is, therefore, thrown back upon the Survey itself.' This represented a new endeavour on the part of the Survey-to encourage and develop an effective interest in archaeological studies. It was realised that the Survey, with its vast network of Branches, Circles and technical staff. was pre-eminently suited to play an important part in imparting training. Wheeler declared: 'Even were a general training in archaeology adequately provided by the Indian universities, it would still be necessary for the Department itself to undertake a large part of the training in technical and applied archaeology.

Wheeler also envisaged that in the developing political environment, the devolution of archaeological administration would take place in conformity with the general spirit of the time; but he emphasised that the technical training and ultimate maintenance of technical standards should remain a Central responsibility.

The School of Archaeology

The inauguration of the School of Archaeology in the year 1959, under the auspices of the Archaeological Survey of India, thus marks the 'fulfilment of a long-felt need'. It represents a systematic attempt at producing a fully-equipped personnel.

The highlight of the course of the School is an intensive practical training in excavation and preservation of monu-To this is added a practical training in surveying, drawing, photography, chemical preservation of monuments and antiquities and museummethods. On the theoretical side, besides traditional subjects like art, architecture, palaeography and numismatics, are taught, with considerable emphasis, prehistory and protohistoric and early historic archaeology. Also included are such subjects of doubtless importance to the professional archaeologist as publication, including block-making printing, and antiquarian laws. course is rounded up by a visit to outstanding monuments, sites and museums.



Students studying the geological formations around Delhi

Crossing the river Beas to study the gravel section



After collecting the palaeolithic tools at Attirampakkam, Madras, the students classify and study them at their camp





The Director lecturing to the students on pottery in their class room



Students and the Director examining specimens in the Central Asian Antiquities collection

ARCHAEOLOGICAL TRAINING IN INDIA

The duration of each course, originally fifteen months, has been extended to twenty, i.e. from October in one year to May in the third. At the end of the course is held an examination, consisting of written papers, practical tests, essay and viva voce and successful candidates are awarded a Diploma by the Government of India.

The School has a well-equipped library of its own. In addition, the students have full access to the rich Central Archaeological Library. Attached to the School is a Central Antiquities Collection housed at Safdarjang in New Delhi, the special feature of which is a vast collection of pottery and other antiquities from important explored and excavated sites in the country. The collection of antiquities of prehistoric and protohistoric periods and later cultures is very unique, in that one gets a complete cross-section of representative sites from all over India. Besides. there are on display several charts and photographs illustrating such subjects

The School functions under a Director, who is a senior officer of the Survey. Other senior officers of the Survey and distinguished outsiders also give lectures on subjects o their specialisation.

as art, architecture and palaeography.

Admission to each course of the School is restricted to ten candidates who have obtained a Master's or equivalent Honours degree of a recognised university in any of the following subjects: Indian History, Sanskrit, Pali, the Prakrit, Persian, Arabic and Archaeology. The qualifications may be relaxed in the case of candidates who are already in the archaeological service. A stipend of Rs. 150 per month is given to

from any source. Students are paid their travelling-fares in railways and buses when they go out of Delhi in the course of their training.

students who may not be drawing salary

It is gratifying to note that the School has already won recognition outside India. Students from Burma and Nepal have been enrolled as students of the School.

The Role of Universities

FOR SEVERAL DECADES, many universi-

ties have been doing valuable work by training students in the theoretical and traditional aspects of archaeology-such as epigraphy, numismatics, art and architecture, etc .- forming part of the post-graduate course in Ancient Indian History and Culture. During the last decade, however, there has been a move in some universities to include the more technical aspects of archaeology, and in this a few universities have been encouraged by the University Grants Commission. Valuable work in this direction has been done by the Universities of Allahabad, Baroda, Calcutta, Lucknow, Madras, Poona and Saugor. The fact, however, remains that we have not as yet achieved a uniformity in the courses of archaeology and field-training in the different universities; apart from a few institutions, in many of the universities there is a great paucity of trained personnel and equipment to impart training in archaeology both in the classroom and in the field. Nevertheless. apart from the professional training that the would-be archaeologist may later on receive from other sources, he must acquire the basic training at the university stage, and for this facilities should be freely available everywhere-bearing

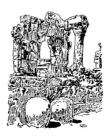
in mind that in no circumstances should the standard be sub-normal.

The encouragement of regional languages and the coming up of the new universities bring to prominance the problem of providing an adequate number of qualified and trained personnel for teaching and excavation. In order to provide free discussion and exchange of ideas in the field of archaeology among the various parts of the country, it would be necessary to envisage an internship period of training after passing out of the university.

It is indeed satisfactory that the Archaeological Survey of India, the only institution of its kind in India, has developed itself into a position whence it can extend a fraternal hand to all organizations like State Governments, universities and learned societies for all archaeological work. The Survey does not

intend to duplicate the training-work, just as it does not intend to retain a monopolistic hold over excavations by placing impediments in the way of others. The supereme criterion in both the cases is 'standard'. It is worthy of note that the Central Advisory Board of Archaeology has been the meeting-ground of the Archaeological Survey of India, universities and States for coordination and exchange of views. Similarly, the School of Archaeology is doing its best to supplement and not supplant the training by the universities.

The role of the Survey (with the School as its integral part) can be summed up in the words of Wheeler: 'The Department is potentially an instrument of highest educational value to India and the world; it is one upon the effectiveness of which the reputation of India as a guardian of cultural interest must in no small degree depend...'.



ANTIQUARIAN LAWS



OF INDIA

A. Ghosh

INDIA is a country where, unlike many other countries, the history of legislation relating to ancient monuments, sites and other objects goes back right into the last century.

The Indian Treasure-Trove Act 1878. lays down that when any person finds a treasure (i.e. an object hidden in the soil or in anything affixed to the soil) exceeding ten rupees in value, he should report the find to the Collector of the District and deposit the treasure in the nearest Treasury or give the Collector a suitable security. If the Collector finds that the treasure was hidden one hundred years before the date of its discovery, he may declare it ownerless and divide the treasure or its value between the owner of the place and the finder of the treasure in the ratio of twenty-five and seventy-five per cent, unless an agreement to the contrary exists between the two parties: if the owner of the place does not present himself to claim the treasure, the whole of it may be given to the finder. The Collector may also, instead of dividing the trea60

sure decide to acquire it on behalf of the Government by paying the parties the value of the material of the treasure together with one-fifth of that value. If any person fails to report the find to the collector or to deposit it in the Treasury or alters the treasure so as to conceal its identity, he will not be entitled to his share of the treasure and will, besides, be punishable with imprisonment for one year or fine or both. The provisions of the Act are thus quite up-to-date, for they prescribe 'compulsory declaration' and acquisition against compensation.

The operation of this Act has enabled the Government to acquire ancient sculptures, hoards of coins, etc., which have gone to enrich museums. It should be noted that if the find of a treasure is reported to the Collector and if the Government decides to acquire the treasure, the finder and the owner will get one-fifth more than the actual value of the material. This is not to deny, however, that in spite of this, ignorant people often conceal their finds and melt down metal objects.

The Ancient Monuments Preservation Act of 1904 referred to, need not be noticed here in any detail, for it has now been largely superseded by the Ancient Monuments and Archaeological Sites and Remains Act. It may be stated, however, that in spite of the provisions of the former Act having become largely out-of-date owing to changes in the system of government, it stood the Government in good stead for fifty five years in the preservation of monuments, regulation of excavations and other allied matters.

The Antiquities (Export Control) Act of 1947 prescribes penalties for exporting or attempting to export out of India any object more than one hundred years old without a licence from the Government.

On the 15th October 1959 the Ancient Monuments and Archaeological Sites and Remains Act, which had been passed by Parliament in the previous year, came into force. Besides adapting the sections of the Ancient Monuments Preservation Act to the present-day requirements, it contains some other salutary provisions.

The Act applies to all the monuments and sites which were declared to be of national importance in 1951, i.e. monuments already protected under the Ancient Monuments Preservation Act and some important monuments in the former Indian States. Besides the Government may add fresh monuments and sites to the list. All such monuments and sites are known as protected monu ments and sites.

If a protected monument belongs to a private individual, the Central Government may enter into an agreement with the owner regarding the maintenance of the monument and other matters. In case the owner refuses or fails to enter into an agreement, the Government may assume some powers for the maintenance of the monument and in certain ways, restrict the owner's right over the monument.

If the Director General of Archaeology believes that the owner of a monument intends to do anything which will endanger the safety of the monument. or to build on or near the site of the monument, he can order the person concerned not to do any such act.

If a monument is used for religious worship, it will continue to be so even after protection.

No person is allowed to excavate, mine, quarry, etc., at a protected site, but normal cultivation is allowed. No building can be constructed on a protected site without permission from the Government; if any is constructed, it may be removed by the Government at the builder's cost.

No person other than an officer of the Archaeological Survey of India can undertake excavation in a protected area without a licence from the Director General of Archaeology. An officer of the Survey can also excavate a site which is not protected.

If the site, whether protected or not, is owned by a private person, the Government may purchase the excavated objects from the owner.

No State Government can undertake or encourage any excavation without the consent of the Central Government.

If the Central Government feels that ancient objects are likely to be destroyed or removed or to fall into decay, or should be kept in a public place, it may purchase such objects. It can also direct that ancient objects should not be removed without permission from the place where they are located.

Offences under the Act are punishable with imprisonment of three months or fine of five thousand rupees or both.

As the Rules framed by the Government under the Act, which simultaneously came into force, i.e. on the 15th October 1959, are of equal importance, they may be noticed here in brief.

Access to monuments is free, except a limited number of monuments where a fee of 20 naye paise (one-fifth of a rupee) is charged, but children below the age of fifteen are exempted.

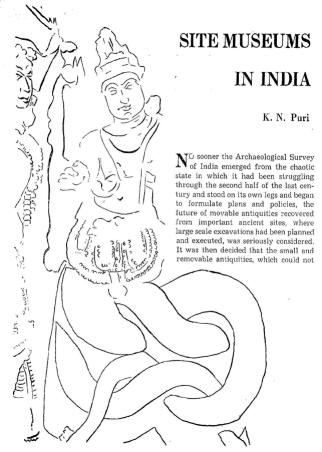
No meetings, conferences, parties, etc., except recognised religious ones, are allowed in monuments. Advertising, selling or canvassing for goods and acting as guides are prohibited except with a licence.

The preparation of drawings and photographs of monuments is, generally speaking, allowed, but the use of camerastands and other articles which are likely to cause inconvenience to other visitors is not permitted. For the preparation of cinematographic films of monuments a licence is required.

If the Government feels that mining-operations or construction of buildings near a protected monument should be prohibited or regulated, it can declare certain areas around the monument as prohibited or regulated. In a prohibited area no mining or construction is allowed; in a regulated area it may be allowed under a licence. Unauthorised buildings may be removed by the Government. These provisions are intended to ensure the safety and beauty of the monuments, but the affected persons will be duly compensated.

A penalty is prescribed in the Rules for the contravention of their provisions'.

^{&#}x27;Adapted from the chapter, 'Laws relating to monuments, sites and other objects', in the author's Indian Archaeology.



which they belonged, in order that they may be studied amid their natural surroundings and original associations and not lose focus by being transported. Systematic excavation of any large site, running over several years of work, produces a harvest of small antiquities, which no single museum, however large, can afford to display in its galleries. Even after distributing representative sets of antiquities to various museums in the country, the collection normally is so large that special arrangements for housing the same are required. On an excavation site of any importance, a field laboratory for the immediate preservation of objects and storage space for the housing of objects thus become essential. It would, therefore, be reasonable to put up a planned museum building, no sooner the potentiality of the site is established for the education and recreation of the general public, scholars and students, who visit the site in large numbers during the period the excavations are in progress and after its close, when the remains are conserved for

posterity.

be preserved in situ, should be kept in

close association with the remains to

site museum in India was established by the Archaeological Survey of India, as early as the year 1904 at Sarnath, near Banaras, where the systematic excavations started in 1904 continued till the year 1928. In the wake of excavations at other important sites, museums came to be established at Harappa, Mohenjo-Daro, Taxila, (all the three now in Pakistan), Nalanda, Nagarjunakonda, Amaravati, Vaisali, Kondapur and Sanchi. In the course of clearance of monuments at the sites of ancient cities

and exploration of the adjoining areas,

large number of sculptures and architec-

tural fragments came to be collected and

discovered. Such objects, that for a number of years were heaped-up in

sculpture-sheds, are now being put on

display in proper museum buildings,

either completed or under construction:

Khajuraho, Kiching, Hampi, Alampur,

Bodh Gava and Bijapur, A museum to

preserve the collections of the Mughal

period, such as robes, carpets, arms,

inscriptions etc. that were recovered

from the Red Fort. Delhi before and

after the rising of 1857, has been in exist-

ence in the Mumtaz Mahal, one of the

In pursuance of this policy, the first

historical buildings inside the Red Fort, for the last 50 years. For housing the relics of the British period in South India, a museum was set up inside Fort St. George, Madras, in a protected historical building, constructed to serve as the "Exchange". Another such historycum-Archaeology site museums was opened in 1959 at Srirangapatna, in the Daria-daulat, which Tipu Sultan built in 1784, for his use during the summer months. Herein are shown relics and objects, belonging to or associated with Tipu, and his noble father Hyder Ali. What may be called an open-air collection has been in existence for a long time at Halebid, the capital of the Hoysala empire. With a view to preserve the cultural wealth of this period, the Archaeological Survey of India propose to establish a proper museum here. As a preliminary, a museum office has been set up in this place with a qualified curator. This may, therefore, be called the latest of the Indian Site Museums.

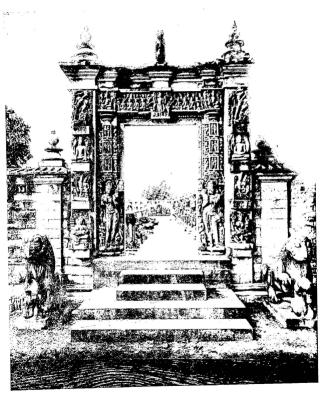
With the exception of the museums at Alampur in Andhra Pradesh, Vaisali in Uttar Pradesh, Kiching in Orissa and Bijapur in Mysore, all the other site museums are under the management of the Archaeological Survey of India, which has a Museums Branch, headed by a Superintendent, whose head-quarters are located in the Indian Museum, Calcutta. He may be addressed for any information required by the visiting scholars and public.

A brief description of the various site museums, scattered all over the country, is outlined below in the alphabetical order of the States in which they are situated.

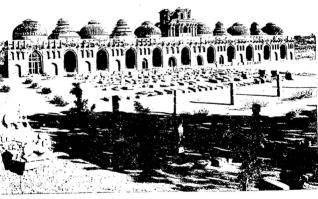
Andhra Pradesh

ALAMPUR. District Mahabubnagar. may be reached by road from Kurnool. The distance is only 15 miles. Taxis are available in Kurnsol town. There is also a railway station called Alampur Road. from where the village is about 4 miles. The Museum was founded in the year 1952 and is housed in a large mandapa. only half of which is roofed over. The collection of sculptures, inscriptions and architectural fragments found locally and from the neighbouring sites, attract fairly large number of visitors due to Alampur being a place of pilgrimage, both for Hindus and Muslims. The township was formerly also known as Dakshina Kasi or the Benaras of the South. There is also a local Dargah where Urs celebrations attract large crowds.

AMARAVATI the spot where the famous Amaravati Stupa, that was razed to the ground by a local landlord in the closing years of the eighteenth century, for burning the stone into lime, lies only twenty miles west of Guntur, on the right bank of the river Krishna. The place may be reached by buses that ply between Guntur town and Amaravati or taxis, available in Guntur, Most of the carved stone panels depicting scenes from the life of the Buddha, that survived, found their way to the Government Museum, Madras and the British Museum, London and a few solitary pieces are scattered in other museums of the world. In the course of further clearance of the site in the beginning of the present century, large number of scattered fragmentary pieces, that once belonged to the stupa, were collected. These stupa slabs, cross-bars, coping stones, figures of Buddha, etc. which



Entrance to the Museum at Khajuraho



The Elephant Stables at Hampi

represent the art of Amaravati that flourished for hundreds of years from the second century B.C., are now preserved in a sculpture-shed. Small scale excavations in recent years have yielded a few crystal relic caskets, sculptures, inscriptions and other minor antiquities and the entire collection now is properly arranged in a small rented house. Construction of a proper building is in progress.

The site of Amaravati is also interesting, as black rouletted ware, as well as Northern Black Polished ware, together with remains of the megalithic culture, have been noticed here. About a mile and half from the site of the stupa, lie the remains of a township, probably the ancient Dhankattaka of early inscriptions, which when properly excavated, may throw valuable light on southern contacts with the north.

Kondapur may be reached from Hyderabad by road, the distance being 38 miles. If one takes a bus from Hyderabad a distance of five miles will have to be footed out, as no conveyance except bullock cart is available.

The ancient site of Kondapur was perially excavated by the Archaeological Department of the erstwhile Hyderabad State. The collection consisting of Buddhist figures made of Kaoline, a whitish clay and terracotta, different types of pottery vessels, punch-marked and Sata-vahana coins, rouletted ware, beads, bangles, iron objects etc., belong to the satavahana period, ranging from the 2nd century B.C. to about the 5th century A.D. They show striking features of the Andhra culture of the Deccan.

Nagarjunakonda: The site may be reached from Gutur or Hyderabad (about 100 miles) by road or from the Macherla railway station on the southern railway, from where it is only fourteen miles.

The discovery of the site of Nagarjunakonda on the right bank of Krishna in the year 1926 and subsequent excavations of the group of Buddhist ruins in the years 1927-31 and 1938-40, resulted in the unearthing of over five hundred stone bas reliefs, beautifully and delicately carved and other antiquities which are housed in a museum, that was ultimately opened in the year 1948. The coins include a gold coin of the Roman emperor Hadrian (A.D. 117-138) and several Andhra lead coins. The slabs which illustrate mostly jataka stories and principal scenes from the life of Buddha, are amongst the excellent specimens of the sculptural art of the time of the Ikshvaku kings (A.D. second to third century). These discoveries have, to an extent, compensated the loss of the Amaravati stupa slabs.

The construction of the Nagarjunakonda Dam, about six miles down stream will, when completed, submerge the ancient site, but for the top of the Nagarjuna Hill, which will stand about 10 ft above the water level in the lake. The ancient site has been thoroughly excavated and explored and a new museum building is being constructed on the top of the hill, where all important monuments have been shifted and rebuilt. This museum island, with reconstructed monuments, will keep alive the name of the submerged ancient site and always stand witness to the pioneer work of transplantation of monuments and their reconstruction, carried out by the Archaeological Survey of India.

Bihar

BODH GAYA, the scene of 'enlightenment' of Prince Gautama, is a place of great pilgrimage, both for the Buddhists and Hindus and is visited by thousands from all over the world. It is situated only eight miles from Gava railway station. The museum was established as part of the Buddha Javanti celebrations and was opened to the public on the 28 December 1956, by His Holiness the Dalai Lama of Tibet. The collection consisting of sculptures and architectural fragments discovered in and around Bodh Gaya had been stored in an open shed near the temple prior to its removal to the museum building. Most of the images and bronzes on display belong to the Pala period. There are also two earlier stone sculptures in the form of Yakshis, assignable to the first century B.C. The collection is being augmented by additions of sculptures found in the district of Gaya and excavations at Bodh Gaya itself.

NALANDA can be reached by road from Patna or from Nalanda Railway Station on the Bukhtiarpur-Rajgir light railway.

Nalanda, the main centre of Mahayana cult and a renowned centre of learning, with a vast campus of temples and monasteries, had been the scene of systematic excavations from 1916 to 1931. The Chinese pilgrims Hieun Tsang and I-tsing, both studied at Nalanda and have left vivid descriptions of life and establishment here. Nothing of the predupta times have come to light in the course of excavations, although accord-

ing to literary tradition both Buddha and Mahavira visited the site. Tradition also records the erection of a temple at Nalanda by Asoka, who is said to have paid homage at the Chaitya of Sariputra, one of Buddha's principal disciples.

Four temples and eight monasteries rleared in the course of excavations and now well conserved, yielded large number of stone sculptures, terracotta plaques, bronzes, seals, sealings, coins, inscriptions on copper-plate and various household objects, mostly belonging to the Gupta and Pala periods (A.D. 414-1154). After distributing representative sets of antiquities to the Indian Museum, Calcutta; the Patna Museum, Patna; and the National Museum, New Delhi, all the rest are housed in the site museum, which was enlarged in 1956-57, on the occassion of the Buddha Javanti celebrations.

One room is devoted to antiquities found in the course of excavations at Rajgir, situated only six miles south of Nalanda.

VAISALI the capital of the Oligarchical Lichhavis of North Bihar and the reputed birth-place of Mahavira, was the scene of the Second Buddhist Council held about a hundred years after Buddha's death. The fortified ruins have been superficially excavated from time to time, in 1903-4, 1913-14, and 1948 and lastly by the Jayaswal Research Institute, Patna, when the remains of an early stupa of the time of Asoka were brought to light with relic caskets. The excavations revealed a sealing of the second to third century B.C. and hundreds of other antiquities ranging upto A.D. fifth century. The finds of earlier excavations are in the Patna Museum but since the year 1945 a museum has been established at Vaisali, mainly as a result of the enthusiasm of Shri Bijauli Singh of Chakramdas village, whose collection of surface antiquities, was taken over by the Vaisali Sangh and subsequently by the Bihar Government in 1950. The Museum contains antiquities from about 100 villages covering the region of Vaisali.

Delhi

RED FORT, DELHI: Mumtaz Mahal, one of the ancient apartments within the Archaeological area of the Red Fort, has been used as a museum the display of historical collections of the Mughal period, since the year 1911. A few-pieces of furniture. copper utensils, jewellery, articles of clothing and other miscellaneous objects either found in the Red Fort after its capture in 1857 or said to have belonged to the palace, are of interest. The collection of charts, Mughal paintings, coins, manuscripts, printed books and specimens of calligraphy afford material for the study of Mughal arts and crafts. Sculptures found in the clearance of monuments in the fort itself and in and around Delhi are also on display here.

Madhya Pradesh

KHAJURAHO can be reached by road either from Satna-a distance of 72 miles,-or from Harpalpur from where it is about 60 miles. The Museum here. at present an unroofed walled enclosure, was established in 1910 and named after W.E. Jardine, the then Political Agent in Bundhelkhand, who enthusiastically helped to acquire the sculptures. The collection consists of a couple of thousand sculptures and carved stones from Khajuraho and the neighbourhood, obtained in the course of clearance of monuments. The sculptures representing Brahmanical, Buddhist and Jain faiths, will soon be housed in the building now under construction. The group of temples at Khajuraho in the Indo-Aryan style of architecture, between the tenth to the twelfth century A.D. by the Chandella Rajputs, with thousands of sculptures on the walls of temples, occupy a most important place in the artistic history of northern India, as this is the only well-preserved group of temples that escaped the iconoclastic zeal of the invading Muslim armies.



SCIENCE IN THE

SERVICE OF ARCHAEOLOGY

B. B. Lal

A RCHAEOLOGY is the study of A humanly made antiquities. In common parlance it is supposed to concern itself with exploration and excavation of old sites and study of monuments, antiquities and other relics of the past. The study of these products of the human mind must necessarily be unscientific, in as much as the subjective element in the human judgment of these products cannot be eliminated completely, and a truly objective approach which is the sine quo non of all scientific studies cannot be adopted in archaeological investigations. The science of archaeology is, therefore, inexact. And it is for this reason that exact sciences like physics, chemistry, biology and geology are now contributing more and more to the solution of archaeological problems and minimising the subjective element which is inherent in all archaeological work.

The methods of archaeological excavations have been so refined by General Pitt-Rivers and later archaeologists that it is possible to pin-point the find spot of every object dug out of the earth. Since every shovelful of earth has to be excavated under skilled and controlled supervision, a modern excavation is a slow and tedious process. The excavator must, therefore, be clear in his mind about the potentiality of a site before he embarks upon a full-fledged excavation. The exploration of old sites is no doubt rewarding, as broken pots and pans, terracotta and other clay artefacts generally found on the surface, offer valuable clues to their archaeological wealth. But this is not enough. Since a modern excavation is a fact-finding operation in which mere collection or duplication of antiquities has no place, a scientific prospecting of potential sites must precede any attempt at actual digging. The prospecting must be scientific to be accurate and it must be quick, since sufficient time is hardly available between the discovery of an archaeological site and its total obliteration by rapid inroads which the modern civilisation makes into open spaces. And here, as in other scientific investigations of archaeological problems, the archaeologist looks to the physicist for unravedling the buried deposits and determining their magnitude and thus assessing

the potentiality of a site. It may be said without any fear of contradiction that the archaeologist is becoming increasingly dependent on the natural scientist for unequivocal solution of all important archaeological problems, such as determination of the scope and nature of prospective sites, identification of materials used in fabricating antiquities, study of methods and materials employed and of the source and provenance of raw materials, dating of archaeological finds on internal evidence and reconstruction of climatic conditions experienced by man since the earliest times. The study of

cultural or material archaeology and the collection of archaeological artefacts

without probing into the environmental conditions under which different cultures had their genesis and decay are out of fashion. Recent developments in scientific techniques have further spotlighted the environmental and chronological aspects of archaeological research. The modern archaeologist are ill afford to treat the scientific techniques recently evolved for archaeological investigations as mere scientific aids; in fact he is increasingly adopting the methodology of natural science for tackling archaeological problems. Ar-

chaeology is so much dominated by a scientific approach and depends so lar-

gely on a multitude of sciences that it

can no longer be said that science is the hand-maid of archaeology, nor is

it any longer possible to envoke scienti-

fic aids only occasionally to serve some

immediate archaeological objective of

secondary importance. All archaeolo-

gical explorations and excavations are

now broad based on scientific principles;

if people and not things must be dug

up, natural sciences must be given their proper place in archaeology. Far from being mere scientific aids, then, the techniques of physics, chemistry, geology and biology have now come to assume their proper place in archaeology. However, a natural scientist is not a machine, which when fed with archaeological material produces an unqualified archaeological answer. The natural scientist has his limitations, as the archaeologist has, and with proper understanding of these limitations, the archaeologist and the natural scientist working in close unison generally succeed in drawing conclusions which largely, if not wholly, resolve outstanding problems in any archaeological enterprise. But this close unison is generally conspicuous by its absence. state of affairs is hardly surprising when those who have had an opportunity to experience such collaboration between archaeologists and scientists have found an absymal gulf between these two disciplines of art and science. The scientist will readily concede that the seasoned archaeologist with vast experience of handling a massive array of facts and material evidence is a calculating machine of extraordinary complexity with an uncanny knack of creating order out of chaos on the basis of typology, but he is also aware of the many pitfalls in such an approach without the guiding light of the principles of natural sciences. It is true the pitfalls have in many cases been circumvented, instances are however, not lacking when even experienced archaeologists have been led astray. It is equally true that there is a growing fad to consign to scientific laboratories indiscriminately selected archaeological material for

quick technical reports, as if the scientist has some wonderful panacea to offer or has a magic touch for transforming antiquities.

Prospecting of Archaeological sites

Physical methods of prospecting have been found to be of great help in surveying archaeological sites. In the exploration of an already discovered site, magnetic and electrical resistivity methods play an important role, as they indicate certain types of abnormal subsurface disturbances, thus providing valuable clues to the archaeologist as to the most fruitful areas in which to insert the spade.

(i) Magnetic survey

It is well known that iron is a most important factor in causing magnetic disturbances. Iron objects, if buried at a site should therefore be detectable by their magnetic disturbance. However, the concentration of iron artefacts with distinctive features is a rare occurrence and the magnetic disturbances caused by other types of archaeological remains under ground, are so feable that a highly sensitive instrument alone can detect them with any degree of precision. With the invention of proton magnetometer. it has been possible to detect archaeological deposits and to locate archaeological structures. This technique of proton magnetometry is destined to play an important role in archaeological exploration

The phenomenon of thermo-remaneur magnetism has been known for a long time. The existence of burnt clay artefacts, pottery kilns, burnt brickstructures and sites which experienced extensive conflagration, was thus expected to be revealed by the study of thermo-remanent magnetism. It was, however, observed that this technique, apart from recording, the normal magnetic disturbances of the burnt clays, was also useful in determining such archaeological strata as filled-in pits and ditches. The scope of the technique of thermoremanent magnetic detection was thus immediately enlarged to cover all archaeological sites and the restriction of this technique to the study of burnt clays only was thus overcome.

(i) Electrical resistivity surveying

Ir is based on the principle that the electrical conductivity of the soil depends on its nature, viz, whether it is filled-in pit, ditch or wall or a uniform deposit. Since electrical resistivity is dependent on the amount of moisture present in the deposit, humus, loam, clay, rock, filled-in pits, post holes, etc. etc., show wide divergence in their resistivity and are thus clearly indicated. Where the rain fall is heavy, the method loses much of its reliability, although abnormal disturbances caused by metallic iron, and igneous rocks in magnetic surveying are rarely present.

Scientific study of archaeological material

As a result of excavation, much archaeological material is brought to light. The study of this material helps in reconstructing the methods and techniques employed in the past for fabrication of artefacts and reveals the nature and provenance of raw materials used, and thus makes it possible for the archaeologist to study the diffusion of various cultures, the development or decadence of technology and the changes in climatic conditions through the ages.

The study of pottery has proved to be a very fruitful line of investigation

in recent years. For this study, chemical analysis, thermo-remanent magnetism, microscopy and emission spectroscopy are very reliable tools. Recently some important methods of destructive analysis have been developed for studying archaeological specimens. Among these may be mentioned the Beta Ray Back Scather Technique. X-Ray Fluorescent spectroscopy, and Neutron Activation Analysis. Extensive use is also made of Fluorescent analysis in Ultra Violet light, Radiography and Infra Red technique for studying the nature and composition of archaeological artefacts and works of art.

Ceramic archaeology

The study of ceramics i.e. pottery, faience, terracotta and other burnt clay objects reveals important information regarding the nature of raw materials, the techniques of shaping and decorating and the conditions of firing, and the nature of tinctorial agents employed in colouring different types of ceramic materials.

Standard methods of chemical analysis when applied to ceramics give us an idea of the composition of clay and the nature of pigments used in producing variously coloured or decorated objects. Surface study of ceramics under the microscope is occasionally found very useful in throwing light on the techniques employed in forming and shaping clay objects. It is of interest to know whether an object was handmade or wheel-turned, and whether the surface was finished by any special method.

In ceramic archaeology, therefore not only is use now made of standard methods of analytical chemistry, but thin sections of fired clay objects are also studied under the microscope for the determination of their internal structure. This technique of ceramic petrography helps us to find out the nature of clay minerals and their fineness and it also gives us an idea of the conditions of firing.

Physical properties of ceramic materials are also studied. For example, it is necessary to know how hard a particular pottery is, and how dense, and whether it is porous or not. Porosity tests are important in the sudy of ceramics, but it may be pointed out that all these properties are not always useful and reliable criteria in the study and identification of ceramics.

Apart from standard methods of chemical analysis, ceramic materials are also studied by emission spectroscopy. The spectrographic analysis is a phyical method of determining the chemical composition of an object. It is based on the principle that when atoms are excited they emit certain radiations which are resolved into spectra and photographed. The emission spectra or line spectra gives us a semi-quantitative idea of the presence or absence of different elements. The spectrographic analysis has a distinct advantage over the standard chemical analysis, since an archaeological object can be investigated and its composition can be determined semiquantitatively without destroying it.

While discussing methods for investigation of pottery and ceramics a reference may also be made to the technique of differential thermal analysis which has recently been perfected for the study and identification of very fine grained materials which are not easily identifiable by the petrographic method. It has not been used in the ceramic archaeology, as it is not satisfactory for the identification of clay minerals in pottery etc, largely due to the relatively high temperatures to which pottery is fired. However, the usefulness of this technique in archaeological field may not be completely ruled out, as there are a large number of sun-baked clay objects which can be studied by differential thermal analytical technique.

By subjecting ceramics to laboratory tests, much useful information is obtained about the condition of firing viz., what was the temperature like and whether the firing was done under oxidising or reducing conditions.

Sometimes the orientation of ceramic objects in the kilns may have to be studied for throwing light on the method of arranging pots for baking. In this matter, the study of thermo-remanent magnetism may be of help.

Beta Ray-Scatter Technique

THIS is a recently developed nondestructive analytical technique for studying the nature and composition of archaeological specimens. The principle evolved is very simple. When Beta ravs are directed towards a flat surface, most of the rays are absorbed by the surface, but a small proportion of these rays is reflected back. The amount of the back-scattered Beta rays is characteristic of the element causing the backscattering. The fact has been used in developing a very elegant device for examining archaeological objects. This technique has been employed for measuring the lead content of glass, glaze, pottery, porcelain and pigments.



Bone figure before and after treatment



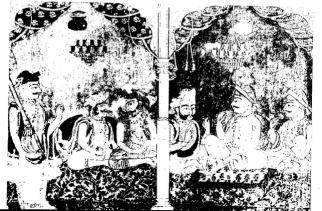




Painting partly restored



Painting before and after retouching and restoration



Neutron Activation Analysis

Another method of non-destructive analysis which has been applied to archaeological material is Gamma-ray spectrometry. It is based on the princinle that when the nucleus of an element is excited by neutrons, it emits Gammarays, the wave-length of which is characteristic of the element concerned

The archaeological material, say a coin or a pot-sherd, is irradicated in a neutron pile. The emanation of Gammaravs from the nuclei of the element under neutron-activation is characteristic in wave-length and half life of the element present in the object under investigation. The Gamma-radiation is analysed and from the results the presence or absence of some elements can he detected

This technique is of great help in identifying rare and precious objects since it is entirely non-destructive. Coins with or without plating and pottery have been extensively studied by this method

X-ray Fluorescent Spectroscopy

This method of non-destructive analysis is of great importance in archaeological investigations, as the composition of archaeological specimens is determined accurately and speedily without damage.

The technique is based on the fact that when an element is excited by directing to it powerful radiation from a high voltage X-ray tube, the inner electrons of its atoms are activated and emit X-rays characteristic of the element. The fluorescent or secondary Xrays which are typical of the constituents of the objects under investigation are analysed by a Geiger or similar counter.

The techniques described above are entirely non-destructive. There are other methods of identifying or analysing archaeological artefacts in which there is appreciable loss of material. These may, therefore, be called semidestructive techniques of analysis. The micro-chemical analysis requires the removal of microscopic quantities of material from the objects under examination: there is thus some loss of the original material. In optical spectrometry, as opposed to X-ray and Gamma-ray spectrometric techniques, small quantities of material have to be drawn from the archaeological objects and in the course of analysis the material is destroved.

Opitical Spectrometry

Ir an electric spark is passed between two metallic electrodes, light is emitted. The emission of visible light results from the excitation of outer electrons of the atoms of the elements present in the electrodes; this light is composed of a number of sharply defined wave-lengths which are characteristic of the elements. If this light is passed through a prism, we get the line spectra of the elements. These emission or line spectra give us a semi-quantitative idea of the presence or absence of various elements. For this reason this technique is also called emission spectroscopy.

For analysis of metallic antiquities, pottery glaze, and pottery and nonmetallic antiquities, small quantities are drawn therefrom and prepared suitably for spectrometric analysis

Optical spectroscopy is a very important technique of partially destructive analysis and is made use of when Gamma-ray spectrometry and X-ray analysis are not likely to yield reliable results. Because of corrosion and weathering which alter considerably the surface composition of all archaeological objects fresh and homogenous material has to be drawn by boring holes. Consequently the two non-destructive techniques mentioned above cannot be used in such cases.

Rediography, Infra Red and Ultra Violet ray methods

Some structural features of corroded metallic antiquities are easily revealed by their radiographic examination. The extent of mineralisation of bronzes is an instance. Hidden details, and structural flaws which are normally indetectable are brought to light by radiographic examination. Similarly the study of archaeological specimens in Infra Red sometimes reveals very interesting information about the obscure details. In the case of old works of art, the presence or absence of carefully disguised over-painting or retouching can be established by studying them under Infra Red rays. Fluorescence analysis in Ultra Violet light helps in identifying the nature of materials used in fabricating different kinds of artefacts. Extensive work has been done on works of art by employing these techniques and very important and interesting results have been obtained. Many cases of forgery of the works of old masters have been detected, and in many cases authenticity of works of art has been established beyond doubt by making use of these scientific methods. In this connection, it would be interesting to recall what Toch has said about the genuineness of works of art.

Even modern painters like Corot and Henner have been copied and a wit once remarked on the witness stand when he was asked how many paintings Corot had painted in his life time, "2500 of which 7500 are in America". Cases of over painting and preparation of true copies of the works of old masters with a view to passing them as genuine and authentic works are legion and in this field the above techniques have been found to be invaluable.

PRESERVATION OF CULTURAL RELICS, ANTIQUITIES AND MONUMENTS

Science has played a very important role in cleaning and preserving museum exhibits, excavated antiquities, prints, drawing, oil paintings, miniatures, manuscripts, textiles, and such objects as ivories, bronzes, wood-work, basketry, glass, glaze, faience, terracotta, stucco, mural paintings and even exposed monuments, inscriptions and sculptures. Most of these methods are chemical, others are physico-chemical, electro-chemical or electrolytic. Purely physical methods such as osmotic elimination of injurious soluble salts from delicate works of art such as wall paintings, and painted pottery have also been used. Occasionally humidity gradients have been utilised for freeing fragile objects from harmful materials.

Ultrasonic technique

RECENTLY a purely physical method has been evolved for cleaning such objects as coins or other metallic antiquities which have got welded together because of corrosion and mineralisation on account of prolonged burial in the soil. The usual standard methods of archaeological chemistry which are so successful in chemical cleaning, treatment and

preservation of metallic antiquities are found to be either very tedious or inadequate. By ultrasonic technique in which high frequency sound waves are allowed to impinge on welded coins or other metallic antiquities, the separation of the cementing material is brought about very efficiently, and all loose corrosion material is knocked away from the surface, thus leaving only the original base metal.

The above methods and techniques are increasingly employed for cleaning. chemical treatment and preservation of metallic, silicons, calcareous, argillaceous and organic antiquities and works of art. The maintenance of such preserved antiquities on museums and picture galleries is also considerably aided by employing scientific techniques. Fumigation, control of humidity and temperatures and illumination of art galleries and museums have to be done on scientific methods for minimising the injury to art treasures and exhibits through the agencies of insect pests, damp, heat and light.

DATING IN ARCHAEOLOGY

Archaeologists usually date their finds by association with other relies of known date. In such a method, much importance is attached to shape, size, colour, mode of decoration, and important and well defined types are compared with undated objects with a view to arriving at as absolute a date as possible. This is typology. Whenever excavated artefacts have been found in association with other objects which are firmly dated such as coins and inscriptions the dating is accurate and no scientific aids are necessary for dating them. When, however, the finds are

not so associated, recourse is had to typology and such objects are compared or contrasted with other datable objects found elsewhere. Such a method of dating is subjective to a degree since typology cannot be reduced to clear-cut formulae or quantitative data.

Direct dating

When the objects are difficult to date by association with other firmly dated relics, recourse is had to scientific techniques. This is precise dating on internal evidence and is any time preferable to dating based on typology. Recently some very elegant techniques of archaeological dating have been evolved.

Radio-carbon dating

The discovery of radio-active carbon (C-14) by Libby has been applied to problems of dating in archaeology, and it has become possible to determine the absolute age of natural carbon-bearing archaeological material from the present back to about 70,000 years. The limitations of the method or the chemical, physical, geological and archaeological assumptions on which the method is based need not be discussed here. Its application to archaeological specimens of known date and provenance have yielded age values, which are in approximate agreement with actual Pates

Facilities for archaeological dating by radioactive carbon will soon be availing to the Archaeological Survey of India. It may be interesting to mention that several specimens from archaeological excavations conducted in this country were examined by C-14 method at the University of Pennsylvania, U.S.A. and the British Museum Laboratory, London. Of these five specimens came from Navdatoli, one from Nevasa and one from Utnoor.

Magnetic dating

It has already been remarked that burnt clays or similar material containing iron bearing inclusions, if allowed to be undisturbed in the earth's magnetic field, acquire a magnetic moment, with a direction parallel to the existing magnetic field of the earth. The magnitude of this thermo-remanent magnetism does not change with time but it is well known that the earth's magnetic field does. If the burnt clay object is heated again, it loses all thermo-remanent magnetism but the fresh thermoremanent magnetism is acquired by it while it cools, and the degree of this newly acquired magnetism depends on the earth's field at that time The inclusions of ferromagnetic material in clays serve as small dipoles which are oriented in the direction of the earth's field when subjected to firing, but when the object cools down, these dipoles do not revert to their original alignment, but are fixed or sealed in the direction assumed by them during firing. The thermo-remanant magnetism of burnt bricks, pottery and any other fired claybearing object such as hearths or kilns causes an appreciable and detectable disturbance in the earth's magnetic field. If this field is measured very accurately, the disturbances are recorded in the otherwise homogenous magnetic field of the earth. Baked clays such as hearths and kilns or undisturbed terracotta and pottery in situ yield valuable evidence about the past behaviour of earth's magnetic field. Baked clavs such as pottery, bricks, terracotta, beads, bangles and similar clay artefacts, being quite durable, are prolificly found at most sites.

Similar types of ceramic ware and clay objects may exist at a number of sites and therefore, such material is suitable for correlation and provenance studies and is used for dating.

The method of magnetic dating is directly applicable to clay objects which have remained undisturbed in situ after firing; it is dependent on the measurement of thermo-remanent magnetism acquired by baked clays. Pottery in situ, brick kilns and hearths or structures which underwent firing can be subjected to magnetic investigations; potsherds and pottery can be studied only indirectly.

In magnetic dating, it is essential to have baked clay samples of known date from different regions which serve as reference for dating other baked clays of unknown date. The calibration is valid for limited areas only. However, this technique is more useful for dating specimens which are not so old as those datable by radio-active carbon; specimens datable to say the last two thousand years belonging to the historical period are very suitable for magnetic dating; radio carbon dating of such young specimens is not very reliable.

Much work has been done in magnetic dating by Thellier and collaborates in France, by Cook, Aitken and associates in England and by Watanabe in Japan. As a result of these developments the magnetic dating of archaeological objects is fast developing into a distinct discipline of archaeomagnetism. At present, however, the method has serious limitations as prior calibration

with reference to firmly dated specimen is necessary before this technique can be used to date materials of unknown period.

Relative dating

THE scientific methods of direct dating described above give the age in years of the objects examined. However, it is not always possible to give an absolute date to a site or to an object. The archaeologist to whom dating of his finds is of vital importance finds himself in a particularly difficult position while studying protohistoric sites for which there are neither written records nor any firm datum line. In the absence of such archaeological evidence, and because of possible inapplicability of direct dating techniques to a particular type of material or site, all that the archaeologists can hope for is a relative chronology which may be built up by placing together available evidence from diverse sources.

For establishing a relative chronology or for determining which artefacts are older than others, many scientific methods are available. They are generally based on such natural cycles as the appearance of sun spots, the oscillations in climate, the sedimentation of clay or the growth of trees rings. Some of them are based on the chemical changes which an object undergoes by prolonged burial in the soil.

Glacial varve chronology

This geological method of dating originated by Gerard De Geer is based on the fact that in the glaciated regions, the reteating ice left a series of annual deposits of clay in the beds of lakes dammed up by glaciers. These deposits

are clearly stratified; these are varied or lamnated clavs and they are periodic. These varved clays are formed because of seasonal changes. In winter, when the melt water is limited, the deposit of clay is thin and fine; in summer with a large volume of water produced by rapid thawing of ice, the sedimentation is considerable and the lavers are coarse and thick. Each cycle of sedimentation. therefore, represents one year; these annual deposits are counted in a series of sections and time scale is evolved for the region of a particular varve from one locality corresponds with or matches a varve from another locality, they are taken to be the deposits of the same year. In this manner and with the help of additional evidence from the study of moraines and other related features. varves from different regions are corelated for building up a chronology covering larger regions. Much work has been done by De Geer, Antevs, and Sauramo on varve co-relation and opinion is still divided about the usefulness of this corelation for working out a reliable chronology for large regions. As a result of varved clay studies. De Geer has worked out a chronology of the end of the last ice age in Northern Europe about 12,000 years ago. The formation of varved clays has also been corelated with the sun-spot cycles.

Tree ring chronology

The technique of tree ring analysis or dendrochronology has been developed by A.E. Douglas. It covers the period of the last three thousand years only, but within this range this method has been successfully adopted to the dating of the prehistoric Indian Settlements in South West U.S.A.

The sequoias of California, which have a long life, have been worked upon for establishing the regional chronology. A few other trees have also been studied in Europe and Sweden for building up chronolgoies for dating.

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Those trees which grow in a climate with marked seasonal changes are found to develop annual growth rings. This is to be expected because the growth of trees is markedly influenced by seasonal changes. Apart from the importance of tree rings as weather gauges and indices of climatic oscillations during the last 3000 years, they are of great archaeological interest and serve to date historical sites. Dendrochronology is based on the fact that the wet springs and summers produce thick growth rings whereas dry winters produce thiner rings. In regions which do not have marked spells of wet and dry seasons and in which uniform humidity conditions prevail throughout the year, the growth rings are uniform in thickness and are not suitable for dating purposes.

Growth rings are studied in the case of trees which were felled on known dates and these rings are matched with those of older trees. This matching is possible as the outer rings of old trees correspond to inner rings of recent ones. In this manner starting with recently felled trees of known date, the dating is pushed back to much earlier periods. This method has been extensively employed in England, Central Europe and Scandinavia. Attempts have been made to corelate the tree rings over long distances, to establish a similarity of sequences of rings in trees of Europe, America and other continents.

Tree-ring sequences are known to show a periodicity or a rythmic variation in relative thickness or thinness of rings, such cycles are found to recur every eleven years. It is well known that the average duration of the sunspot cycles is also of the same order. the composite periodicity of the sun-spot being 11.2 or 11.4 years. The tree rings cycle has been found to coincide with the sun-spot cycle.

Palynology

It is not a direct method of absolute dating of archaeological sites and objects, nor can this method be treated as a direct method of relative dating. Glacial varve analysis and dendrochronology are based on natural cycles which give us an idea of time and thus these methods are helpful for building up relative chronologies. In palynological investigations, the aim is to reconstruct climatic calendars on the basis of microscopic identifications of tree pollen from different regions. The pollen is found in peat bogs, organic lake deposits and mud. The pollen grains are fossilised and are well preserved in such deposits having been deposited in large quantities by wind. The pollen content of peat or mud is more or less a true index of the floral assemblage at the site of the specimen; thus indicating general climatic conditions witnessed in the past.

As a result of intensive researches it is now well known that marked climatic changes have taken place since the last Glaciation. These climatic oscillations, as has been discussed earlier, are recorded in the growth rings of trees and in varved clays. Pollen analysis helps in the construction of climatic zones which in conjunction with dating evidence derived from the study of archaeological remains found in association with similar zones elsewhere serve as time scales for building up reliable chronologies.

Much work has been done on pollen analysis in Britain and on the Continent; as a result of these studies, a large number of prehistoric and Bronze and Iron Age sites have been assigned to various climatic phases of the post Glacial.

Chemical dating

In some cases archaeological remains can be dated by chemical analysis. Like radio-carbon analysis, chemical analysis is another method of dating archaeological material on internal evidence. But the latter technique gives only the relative date; the dating by o radio-active carbon is absolute. Bones which have remained buried in the ground for long periods cannot be dated by C-14 techniques; the range of this method is limited to 70,000 years beyond which the radio-activity of carbon bearing material including bones becomes too feeble to be detected by any available technique. Consequently bone dating back to early pleistocene cannot be examined by radio-carbon method. Such bones can be relatively dated by chemical analysis. The analysis involved the estimation of fluorine, nitrogen and uranium.

The chemical method of dating bones is based on the fact that bones which have been buried in the ground are enriched in fluorine content because the bone material which contains hydroxy apatite has a tendency to absorb fluorine from ground water. The fluorine reacts with hydroxy-apatite and is re-

The rate of this tained in the hones. reaction depends, among other factors on the fluorine content of ground water which has come in contact with the buried bones. The longer the bones have remained buried in the ground, the higher is the fluorine contents until a limiting value of fluorine is reached beyond which no more fluorine is taken By chemical analysis the fluorine content of old bones is determined very accurately and this helps in fixing the relative ages of bones which have been found at a site. The method is, therefore, applicable to limited areas having the same fluorine content in ground Bones which have come from water. different regions cannot be dated, since the fluorine content of ground water varies from area to area.

Uranium which is almost nonexistent in fresh bones is also taken up
by buried bones and the determination
of uranium concentration thus gives a
reliable indication of their age. This
method is useful in two ways, firstly because of its high sensitivity since uranium is radio-active and secondly because the method is non-destructive,
and bones can be examined for their radio-activity without suffering and damage.

The nitrogen concentration of bones creases steadily with prolonged burial. Fresh bones contain a fairly appreciable quantity of nitrogen, roughly 4%. On account of burial, the nitrogenous material in bones, collagen, diminishes at a rate dependent on several factors. If air and bacteria are excluded, as when bones are buried in clay or when ground and sub-soil water remain frozen, the nitrogen content remains fairly cons-

tant. Here, then, is a chemical method of determining the relative ages of bones which have remained buried in the ground under comparable conditions.

The chemical method of dating is a powerful tool and if the analytical data on uranium, nitrogen and fluorine are correlated, the relative dating is perfectly reliable. Phosphorous and iron content of bones are also determined with a view to eliminating the disturbing effects of extraneous material which may not be easily and completely removable. In this connection, the case of the Piltdown man may be recalled. It was on the basis of fluorine and nitrogen estimations that this so called specimen of Eanthropus Dawsoni was proved to be a fake. Chemical evidence was also adduced to show that the iaw bone had been artificially stained with a chromium compound, probably potassium dichromate.

Ultrasonic dating

ATTEMPTS have been made to apply the technique of ultrasonics to the problem of dating of bones. It has been established by Specht and Berg that the velocity of sound waves in bones decreases with age. The velocity of sound in bones which are 500 years old is half the velocity in fresh bones; in bones which are 5000 years old, the velocity of sound is reduced to 25%. However, the decrease in the velocity of sound in bones of varying age is not uniform and the accurate determination of their age may be difficult on account of several disturbing factors such as calcifiction. silicification or ferrugenisation of bones. The method, which is non-destructive. may be of limited use in relative dating under favourable conditions.

Thermoluminescent dating

This technique has recently been applied to archaeological objects such as pottery, bricks, terracotta and other baked clays.

The method is based on the fact that clay minerals suffer damage due to nuclear radiation; the radiation damage sets up strains and distortions in the crystal structure of clay minerals. By heating such objects the strains and distortions disappear. In the course of their release minute but detectable amount of visible light is emitted.

When clay objects are fired, all strains and distortions acquired by clay minerals before firing are released. When, however, such fired clays are allowed to remain exposed to nuclear radiation for a long time, accumulation of radiation damage takes place afresh and this is used for determination of age.

The nuclear radiation responsible for causing distortions and strains in the crystal structure of clay minerals is derived from radioactive disintegration of thorium and uranium which are present in very minute amounts in most rocks and clays. Alpha-particles shot out of thorium and uranium nuclei excite the electrons of the atoms in clay minerals to high energy levels. heated to several hundred degrees centigrade, the electrons revert to their normal low energy levels and in the process emit visible radiation, the magnitude of which depends on the duration of exposure of the clay objects to nuclear radiation as well as on the composition of the clay, and its uranium content. For this reason, the natural radigactivity of a clay specimen has to be measured and the accumulation of radiation damage as a result of exposure to measured quantity of alpha rays from a suitable source has also to be studied.

The thermo-luminescent dating has great potentialities. It is of much wider application on account of availability of copious quantities of pottery, terracotta and red clays at most sites; suitable carbon bearing specimens for radiocarbons dating are not always available in required quantities and number. Its advantage over the magnetic dating technique lies in the fact that in situ specimens are not required for measuring thermo-luminescence; and magnetic dating, the specimen must be available in situ—a requirement which severely restricts scope.

Environmental archaeology

THE study of environmental conditions in which man has lived through the ages is an important aspect of archaeology. And it is in this field of environmental archaeology that vital contribution has been made by science and results of far reaching importance obtained by scientific techniques. Geology and palaeontology have helped in the study of climate, chronology and faunal succession, of the pleistocene.

The study of river terraces, raised beaches, weathering sediments, and buried soils which has given invaluable data on climatic oscillations is based on scientific techniques of geology, botany, zoology, physics and chemistry. As a result of putting together diverse methods of these sciences, a new branch of science called geochronology, has been evolved.

Geochronological investigations into historical and prehistoric sites have yielded invaluable data about the climatic fluctuations in the past. Most of the methods of geochronological research have already been briefly described.

The study of soils and gravels which are potential records of the climatic changes in the past has been found to be very useful in the study of prehisto-Both mechanical and chemiric sites cal analysis are necessary for study of soils and earths from prehistoric sites and caves. The determination of humus and phosphate and the study of movement or deposition of iron, alumina, silica and alkalis help in reconstructing the climatic conditions witnessed by a In fact geochronology is a fast growing science which has already made considerable contribution to prehistoric archaeology and is likely to add more and more to the knowledge of palaeoclimate and the environment of early man.

WORK DONE IN INDIA

THE scientific methods mentioned above have been extensively employed by the Archaeological Survey of India for chemical analysis, scientific examination and treatment and preservation of archaeological materials of diverse kinds such as metals, alloys, terracotta, glass, glaze, faience, prints, drawings, fextiles, mural, oil and miniature paper paintings, inscriptions, sculptures and monuments. The excavated material has also been examined, analysed and chemically treated with a view to throwing light on the techniques and materials employed in their fabrication, and determining their archaeological significance. The growth and development of

these various methods in India during the period of more than four decadesfrom 1917 when the scientific work on museum exhibits and other archaeological materials was initiated by the Archaeological Survey of India to the present day-could not remain isolated from the scientific progress made by other countries which had made considerable progress in researches in physics, chemistry, geology, as a result of which numerous techniques of universal use in the conservation of monuments and other archaeological relics of diverse kinds had been evolved. These methods, which have been briefly discussed above, were adopted by the Archaeological Survey of India in its own work for it was soon realised that the study of ancient techniques and materials could be carried out only by assiduous application of the results of researches in these various branches of science. These investigations have been steadily pursued in an endeavour to elicit available evidence for correct interpretation and evaluation of archaeological material which has been growing steadily as a result of all round expansion in the activities of the Archaeological Survey of India. Archaeological specimens of various kinds such as metals, and alloys, glass and glaze, pigments and painted stuccos, mortar and plaster, terracotta and faience, mural and oil paintings have been systematically examined and analysed by using some of the methods described above.

Analytical chemistry has played a vital role in the solution of archaeological problems in this country. The ceramic material which was unearthed in profusion at Mohenjo-daro and Harappa has been chemically analysed in great detail and valuable evidence has thus been adduced about the techniques and materials employed in those times. Much light has thus been thrown on the development of material civilisation of protohistoric India as revealed at these sites. Detailed analysis of glass and glaze, unearthed at Taxila and other Buddhist sites has contributed to our knowledge of the technological developments in the historical period. Similarly the chemical analysis of glass specimens from Nalanda, Arikamedu Ahichchhatra, and other sites has vielded much valuable information about the composition and origin of the raw materials. The study of glazed tiles from Chini-ka-Rauza at Agra, apart from revealing the composition, has led to the conclusion that the tiles were manufactured not by Chinese but Persian craftsmen or their Indian pupils. Similarly the chemical analysis of glazed tiles from Sher Shah's tomb at Sasaram and from a mosque at Narnaul has yielded interesting results. The composition and technique of glazed pottery of Kushan times have also been Glass specimens from determined. Hastinapur have also been analysed and the results so obtained reveal the nature and composition of the raw materials and give an insight into the technological developments in glass making and working. Reference may also be made to the very interesting results obtained by a careful and detailed analysis of polychrome glass from Bellari, Kolhapur, Maski, Nasik and Maheswar.

The study of ancient and mediaeval ceramics has not been confined to glass and glaze only; terracotta, pottery and faience, have also been studied and analysed in great detail. The Northern black polished ware has been subjected to

chemical analysis and petrographic examination with a view to determining the technique employed in its fabrication. The nature of the body material and the lustrous black surface has also been studied, but further investigation is necessary for an unequivocal determination of the technique of final dressing of the ware and formation of the black to steelgrey lustrous surface. The problem is further complicated by the presence of decorative patterns in cream, buff and red on this shining surface.

Glazed celadon ware which was excavated at Arikamedu formed the subject of another detailed investigation; this study has helped to fix the date of its manufacture on internal evidence.

A large number of specimens of pottery from Arikamedu have been examined and analysed. The presence of an incrustation of old resin on the inner surface of a sherd of amphora from Arikamedu, as proved by chemical analysis, shows that the vessel was employed for storing oil or wine. It would be interesting to recall in this connection how fluorescence analysis was helpful in determining the resinous or asphaltic nature of pottery. The pottery from Arikamedu has been examined extensively for determining the materials and techniques employed, and it has been found that the techniques of salt-glazing was practised and slips made of haematite or ferruginous clay were in use.

A comparative study of the Northern Black Polished Ware and the Southern Black Polished Ware (Megalithic Black Ware) has shown that the two wares are readily distinguishable on account of distinct techniques employed in making them. The technique of Northern Black Polished Ware has recently been investigated in the British Museum Laboratory, but the results are inconclusive.

The Andhra painted ware of Brahmagiri has been found to be salt-glazed and painted in white using kaolin, or lime.

Much work has been done on the Painted Grey Ware of Northern India, the russet coloured ware from the Andhra levels at various sites in South India and the Deccan, and the Black and Red Ware of South Indian megaliths.

Detailed investigation has also been conducted on the pottery from Rangpur, Lothal, Ujiain and Nagda. The results of these investigations are of considerable interest and will appear in the archaeological reports of these sites.

A detailed investigation of faience yielded by excavation or exploration of several sites has recently been taken up, with a view to determining the nature and composition of the specimens and the techniques of their manufacture. Particularly important in this connection is the point whether the methods and materials employed for making faience artefacts in protohistoric times have been practised without any marked modification in later periods, outfifterent techniques and materials were evolved with the passage of time.

The technique of chemical analysis found so fruitful in the study of ancient and medieval Indian Ceramics has also been extensively employed for the investigation of metallurgical and metallographic problems presented by metal and alloy specimens recovered in the course of excavations. Interesting and important results have been obtained by

chemical analysis of specimens from Mohenjo-daro and Harappa. They show that the ancient craftsmen had obtained a high degree of skill in metallurgy and metal-working and that the technique of casting and working bronze was well understood. Bronzes from Nalanda have been investigated in detail. Metal and alloy specimens from a number of sites, viz., Ahichchhatra, Brahmagiri, Bisauli, Bahadarabad, Hastinapur, Rangpur, Lothal, Nagarjunakonda, Ujjain, Nagda and several other sites have been chemically analysed and examined with very interesting results.

Attention has also been paid to the study of materials used in the construction or decoration of ancient monuments. Specimens of paint, lime wash, plaster and mortar have been collected from a number of monuments and sites, viz. Bhubaneswar and Konarak temples. Golgumbad, Bijapur, Golconda Fort, Rang Mahal, Chamba, temples at Tanjore, Lepakshi, Sompalle and Chanda. Sarnath, Sanchi, Nalanda and Gilund. stupa and other sites at Nagarjunakonda. The chemical analysis of these building-materials has thrown much light on the methods and materials used in ancient and medieval times.

Extensive work has been done in recent years on the chemical treatment and preservation of temples, rock-cut caves, sculptures and inscriptions. The Lingraj Temple, Bhubaneswar has been subjected to elaborate chemical treatment for elimination of injurious soluble salts and algae. Suitable fungicides have been used for preventing the recurrence of moss and lichen on this temple. The results are very satisfactory. The Kandariya Temple at Khajuraho has also

been treated and preserved by using the latest scientific methods and materials. As a result of intensive and extensive chemical conservation, many temples, sculptures, inscriptions and decorated stone work have been rescued from decay which had assumed alarming proportions. Some of the sites where elaborate preventive treatment has been carried out are Elephanta, Karla, Bhaja, Kanehri, Bhubaneswar, Khajuraho, Nalanda, Sanchi, Sravanabelagola, Bajnath (Kangra) and Chitorgarh.

The problems of weathering and decay of the more important monuments have been studied in detail. The Suntemple at Konarak and the Shore temple at Mahabalipuram present complex problems of scientific conservation. Petrographic examination and chemical analysis have helped to determine the causes of their decay. It has been found that the highly ferrugenous khandolite stone used at Konarak has decayed on account of kaolinization of falspars and limonitization of garnets. This has resulted in the leaching of alkalis elimination of silica and accumulation of the sesquioxides. The recommendations of the Konarak Committee appointed by the Government of India are being implemented and the chemical conservation of this temple is being taken up shortly.

The Shore Temple at Mahabalipuram is virtually saturated with sea salts due to direct beating of waves which has been going on for centuries. The coarse-grained rock of the temple is being reduced to powder; the salt action is going on uninterrupted because of salt-laden winds and sprays. In such adverse condition of location and the extreme environmental conditions, no method of conservation is likely to be successful.

The preservation of temples, rockcut caves, stuccos and other constructional and monolithic monuments is a complicated problem and the latest methods anod materials evolved for such work in other countries are studied and suitably adopted to their conservation.

Some ancient monuments are embellished with mural paintings. Paintings being very delicate objects and susceptible to damage and injury due to diverse causes, prompt action is called for in order to arrest incipient damage and to preserve and protect them from further deterioration. Extensive work has been done in India on treatment, preservation and conservation of wall paintings at many sites. The mural paintings at Ajanta and Ellora have been and are being kept under a constant vigil so that their preservation is ensured and no damage is done to them. By using suitable solvents, detergents and preservatives, the flaking or blistering paintings have been fixed to the wall to prevent any possible loss of pigments or painted plaster. The darkened paintings have been very carefully treated and obliterated details brought out by systematic chemical cleaning. The loose pigments have been secured to the priming and the plaster fixed firmly to the

Similar work has been done in the caves of Bagh, Badami, Sittannavasal, and the temples of Conjeevaram, Tanjore, Lepakshi, Sompalle, Chanda and Talbahat.

Paintings in the monuments at Fatehpur-Sikri and Sikandara and those at Itmadud-daula, Agra, Red-Fort, Delhi, Khosrobagh Tomb, Allahabad, and Tambekarwada, Baroda have also been treated and preserved by employing latest scientific methods and materials.

In India, geochronological investigations have recently been taken up for studying past climatic conditions. The microlithic site of Birbhanpur, which was excavated a few years ago has been studied from geochronological stand point and the results have already been published. Further work in this direction has been done and the results, which are interesting, will shortly be published. Soil analysis comprising mechanical analysis, heavy mineral analysis, pH study, phosphate and humus detection, has been taken up in the case of several recently excavated sites, and these results will be published in due course.

THE EARTH

RABINDRANATH TAGORE

TODAY at the altar of the day's end, as it bows in a last salutation,

I make thee my obeisance—accept it, O Earth!

O THOU Valiant, thou art for heroes only.
Opposites meet in thee: at once soft and hard,
Thou partakest of the nature of both man and woman.
The life of man thou swayest with an excruciating
conflict.

With thy right hand thou pourest nectar, With thy left thou breakest the chalice,— And fillest thy playground with mocking laughter. A high price thou puttest on what is worth having, Makest the heroic life difficult of attainment, The right to a great life hard to earn:

No mercy thou showest to those who ask for it...

No mercy thou showest to those who ask for it..

Every tree thou bearest hides the story of battle-scarred

moments.

Thy fruits and crops flaunt the garlands of thy victories. Over sea and land range thy remorseless battlefields, Where death sounds the clarion of the victory of life. Thy ruthlessness is the foundation on which civilisation builds its triumphal arch:
If there is any lapse, total destruction is the price thereof.

THE demon ruled the beginning of thy history with a might invincible,—Rough, savage, insensate.

With mace and club in his big, fat, clumsy hands, he played havoc with the seas and mountains, And muddled the skies with a miasma of fire and gas. A despot of matter, he had a blind hatred of life.

THEN came the gods,
Who pronounced the charm that quelled the demon.
The insolence of matter was curbed.
The Mother of Life spread her green mantle for her children:

On the orient mount stood the Dawn:

Evening descended with her spell of peace on the shores

of the West.

THE shackled demon was brought low:
Yet that primeval savage clings to thy history.
Into order he brings a sudden anarchy:
Out of the dark crypts of thy nature he wriggles out
all of a sudden:
His lunacies still affect the workings of thy pulse.
Day and night the sky, the air, the forests
Ring to the exalted chant of the gods, soft and loud:
Yet out of the cavern of thy breast that half-tamed
serpent-monster
Lifts his hood from moment to moment;—
Goaded by him thou hurtest thy own creatures;

Ravagest thy own creations.

TODAY, at thy footstool resting on evil and good,
I shall place the obeisance of my scarred life—
A homage unto thy greatness so terrible and so beautiful.
The massive life, the massive death, secreted in thy bowels—
Today I touch it and feel it all over my body and mind.
The vanished remains of countless men of countless ages are stored in thy dust.
I too shall leave behind a few handfuls of dust—

The residue of all my joys and sorrows— Leave them behind amid this silent dust-heap that swallows all names, all shapes, all identities.

EARTH that art fast-bound, Earth that voyagest freely amidst the clouds,

Earth that art steeped in the great silence of the mountains.

Earth that art astir with the ceaseless roar of the azure seas. Blessed with thy fruits, thou art beautiful: devoid of them, thou art terrible. Here, thy cornfields bowing with ripening harvests-Where daily the radiant morning sun wipes out the dewdrops with its mantle of light. And the setting sun leaves its unspoken happiness undulant on the yellowing corn. There, the devil-dance of mirages in deserts Water-less, fruit-less, fear-stricken, skeleton-strewn. In Vaisakh I have seen thy storms swoop like a dark hawk on the lightning-pecked horizon; From end to end the sky roars like a lion puffing its The swish of its tail sends the mighty forest-tree, its branches in disarray, Grovelling in the dust in despair; The blown-off roof a broken hut rushes in the van of the wind. Like an imprisoned bandit who has broken his chains and makes a bid for freedom. Again, in Phalgun, I have seen the mild warmth of thy southern breezes Strew soliloquies of union and separation in the scent of mango-blossoms; While the lunar chalice brims over with the foam of nectarean wine: And the sylvan murmur; impatient with the impertinent wind, Bursts into a sudden babble.

SUAVE thou art, thou art brutal, old thou art, thou art
ever new.
In some immemorial dawn thou emergedst from the
sacrificial fire of a dateless creation;
Over thy circling ways thou hast scattered the remains
of hundreds of dilapidated histories, all meaning spent;

Host laid, without a twinge of remorse, thy rejected handiworks

On layers of countless oblivions.

MOTHER of Life, thou hast kept us
In small cages of fragmented time—
Within which all our pastimes must end:
All our glories.

T's with no illusions that I have come before thee today:
I would not claim from thee any immortality for the

That I have strung bit by bit all this life.

If I have paid the right price for a seat in a tiny fragment Of those mammoth moments that emerge and vanish In the course of thy multi-million-year circuit round-the

If, with sorrow immeasurable, I have conquered but one fruitful fraction of life:

Then put on my brow just one earthen mark of yours—
The mark that will fade

On the night when all marks fade into the Great

O HEARTLESS Earth,

Before thou forgettest me quite,

Let me place my obeisance today

At thy implacable feet.

TRANSLATED BY TARAKNATH SEN

This poem appeared in the Tagore Number of Cultural Forum in November 1961.
The sequence was disturbed inadvertently.
Apologies are ofiered to the translator and the poem is given above in its correct sequence.

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