NATURAL HISTORY

VOLUME XXV MARCH-APRIL NUMBER 2

Glimpses of India*

INCLUDING AN ACCOUNT OF THE FIELD EXPERIENCES OF THE SIWALIK HILLS INDIAN EXPEDITION OF THE AMERICAN MUSEUM

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IN the days of clipper ships, when traveling was arduous, voyagers returning from the Far East were wont to bring back marvelous stories of the countries visited: religious rites, fakirs, gorgeous pageantries; things so different from western experience that none could hear without wishing to see. None of the tales were more startling than those coming from India.

Many of the early descriptions savor of the *Arabian Nights*, for India is typical of the East, where time moves slowly. Today is like yesterday or the day before in rural parts; hence the contrast so vivid to westerners. One may still see the same conditions that surrounded the great Mogul emperors, even back to the days of Gautama Buddha, whose cult has long since moved eastward.

We of the American Museum staff have long cherished the hope that some day our halls would be enriched from India, and the Museum explorations in China and Mongolia made it increasingly more important that we should have a representative collection of fossils from the famous Siwalik Hills of India, and the lesser known areas of Burma. The generosity of Mrs. Henry Clay Frick made these hopes possible of realization, and it was with keen satisfaction that I received the appointment from President Osborn to carry on work in these regions.

Calcutta, where I hoped to establish relationship with officials of the Geological Survey of India, was my immediate objective, but Bombay is the first port of call from the west, and the rail journey of 1500 miles separating these great ports saves time and gives an opportunity of seeing the central part of this vast empire, remnant of ancient Gondwana land.[1]

One unacquainted with India through a personal visit may think the term "empire" grandiloquent, but no other word can adequately encompass this vast area, with its 300,000,000 people, more diverse in race, religion, and language than combined Europe.

A few hours in Bombay afford time for little more than a hasty visit to the Museum of the Bombay Natural History Society, which is doing such admirable work in India, and a drive to the Towers of Silence, the Parsi place of the dead. A considerable part of the population is made up of Parsis, whose tenets are not to pollute the elements fire, earth, or water; wherefore the dead are placed in towers, to be disposed of by vultures. It was a happier thought to watch the evening strollers, the women draped in multicolored toga-like *saris*, as brilliant as the flowers they cast upon the waters.

At first it is rather startling to learn that you must carry your bed every-

[1]For a map of the ancient land masses that subsequently united to form the Asiatic continent, the reader is referred to p. 134 of the article "The Discovery of an Unknown Continent," by Henry Fairfield Osborn, NATURAL HISTORY, March-April, 1924.

*Illustrations by the author and by Mrs. Brown

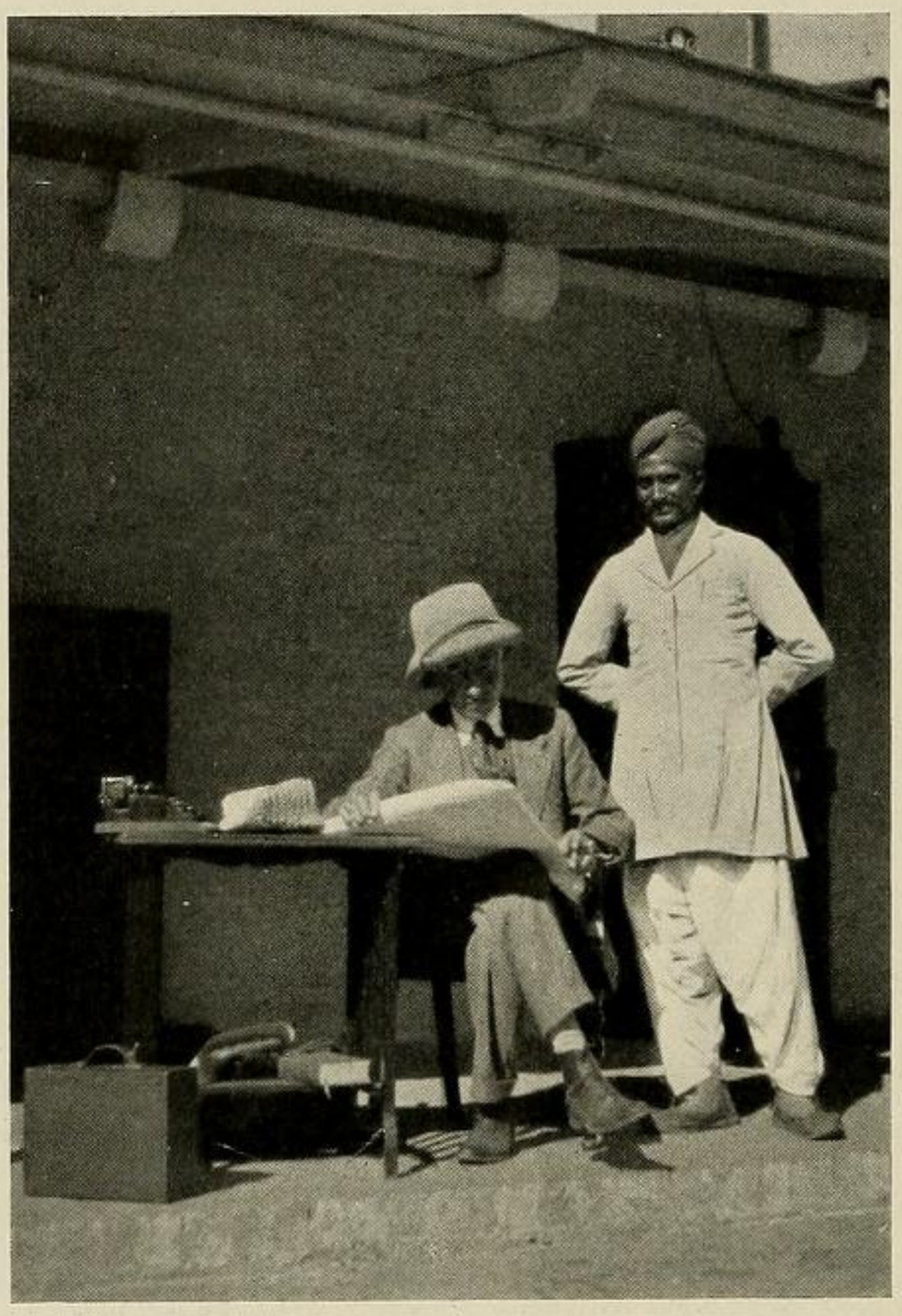
WHERE A SHORT DISTANCE WAS A LONG WAY

In the Upper Siwaliks near Siswan an elephant skull weighing a ton was found in a place accessible only to men on foot. So that the skull might be carried out, borne on poles to the cart awaiting it a mile beyond, the winding stream bed along which the porters struggled with their load had to be filled in wherever unevennesses occurred

where, on railway journeys and in most hotels. Wherever you go, there are countless servants, but none to do your bidding unless under personal hire. No white sahib may carry even a small package; indeed few want to where service is so cheap, and reduced railwayfaresandhotel charges are provided for servants. If your stay is long enough, by process of elimination you acquire a good retinue–cook, personal servant, and the like, *ad lib*.

Midway between Bombay and Calcutta in the Central Provinces lies the favored hill station, Jubbulpore. It was here that so long ago as 1828 a British officer, Captain (later Major General) Sleeman, first discovered dinosaur bones in India. This deposit, of middle Upper Cretaceous age, has been examined subsequently and many bones have been recovered, chiefly those of large sauropods, which are of more than passing interest from the fact that their placement indicates that the life of these giant reptiles was here prolonged to a later geologic date than is evidenced by discoveries in other parts of the world. The American Museum was enriched by representative specimens from this horizon.

The rail journey across central India is not attractive in views, nor does one sense the density of the population in the country traversed. Most of the inhabitants cultivate the soil, but there are neither fences nor single houses to mark individual ownership. Villages upon villages, unpretentious in appearance and of monotonous occurrence; temples far and near!



Mr. Brown and his Mohammedan leader, locating the next camp.—Faithful as a right hand, punctilious as a major, solicitous as a mother, Abdul Aziz smoothed many a hard way for his master

As we cross the Vindhya Mountains, not made up of peaks and jagged scarps, but harder remnants that have resisted erosion on a long, stable surface, we begin to sense the great time periods involved, and nature's influence on this passive people, whose fate it is to be born, to live, and to die in unchanged caste. From these mountains came many of the diamonds that give luster to history and fable. The "Great Mogul," the "Orloff," the "Koh-i-noor," the "Pitt," all came from India.

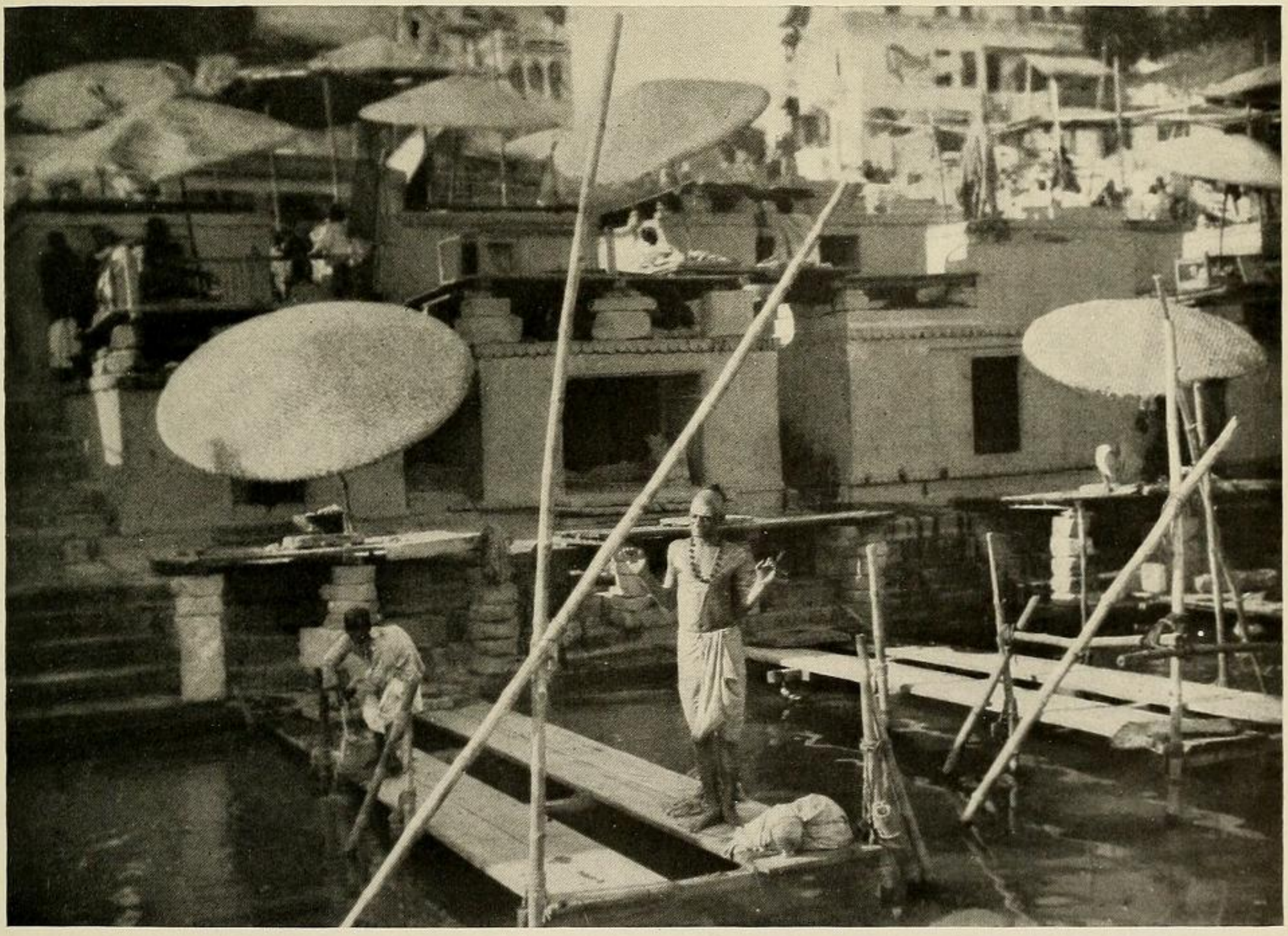
Mr. Guy E. Pilgrim, head of the palæontological department of the Geological Survey, was away on field duty in the northern states when I arrived in Calcutta, but a letter bade me join him in camp on a date that gave ample time to investigate along the way.

Calcutta as a municipality is no more distinctly Indian than New York is American. There are parts

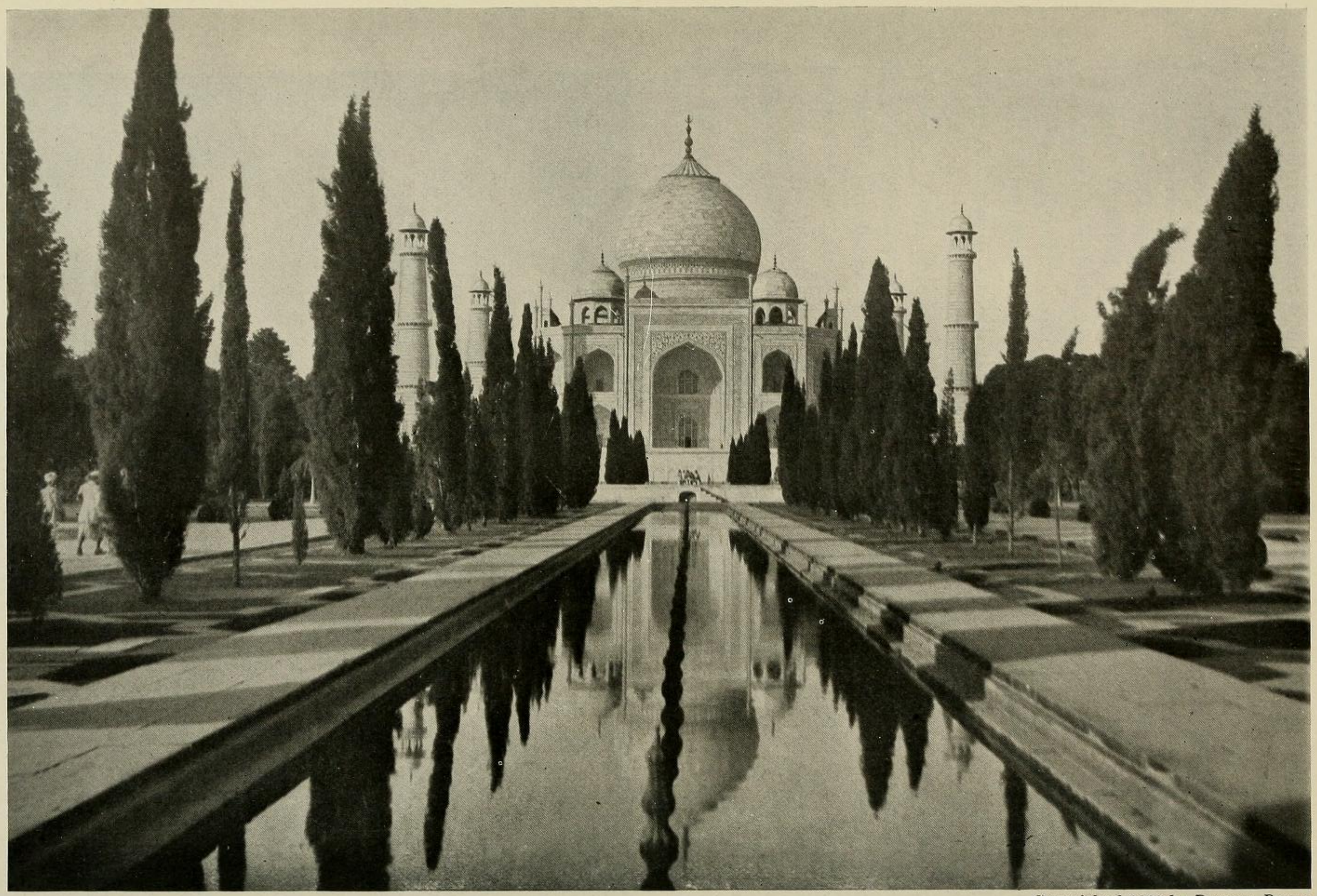
purely British and parts purely Bengali, but there is little of admixture. A vibrant stir and a quickening pulse make one realize that here is the commercial center of India. The Hooghly River is filled with shipping; there are broad avenues and beautiful edifices. You pass down Clive Street, with magnificent bank buildings to right and to left, a dense moving crowd on either side; suddenly you stumble over a huge bull lying on the sidewalk chewing its cud leisurely, oblivious of the hurrying throng, and you remember that you are in the Hindu country of the Sacred Bull.

Northwest of Calcutta in the provinces of Bihar and Orissa, a night's ride by rail, lie some of India's extensive coal fields, Carboniferous and Permian in age. Overlying them are broad exposures of Triassic sandstones, where early Survey workers found remains of labyrinthodonts, fishes, and dicynodont reptiles. Near Asansol my search was rewarded by the discovery of bones representing most of the forms already described and some not heretofore known.

No part of India holds so much of historical interest for the traveler as the Punjab, that northern province drained by the five great tributaries of the Indus, and the United Provinces watered by the Ganges. It was in the latter region on the banks of the Rohini, not far from the present city of Gorakhpur, that Gautama Buddha was born between five and six hundred years before Christ. A few monuments and building basements made by his faithful followers are still to be seen at Sarnath, near Benares, and at Taxilla, near Rawalpindi; but here

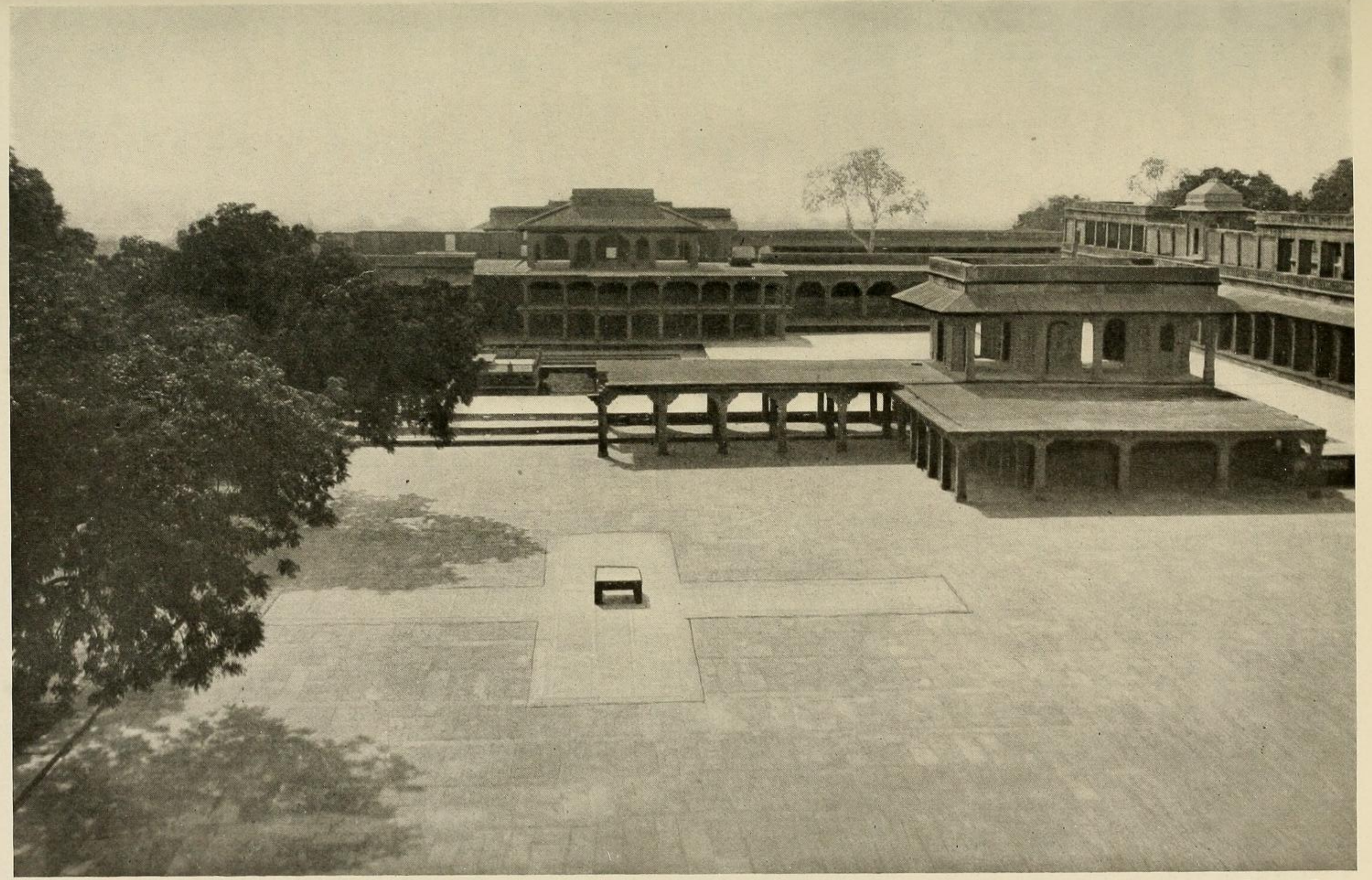


A section of the waterfront in Benares.—The ascetic in the foreground stands all day with hands uplifted, his face to the sun. Another, in front of him, remains prostrate, venerating the sacred river. Bands of pilgrims arrive constantly and the river front always presents a festal appearance



"PEARL OF THE ORIENT"

Neither photographs nor words can adequately portray this greatest of monuments, the Taj Mahal, tomb of Mumtaz, wife of Emperor Shah Jahan. It is a fitting and perfect expression of a great love for a woman



AUDIENCE HALL AND QUEEN'S APARTMENTS AT FATEHPUR SEKRI

In every detail this palace of Akbar, the Great Mogul, is as perfect as when constructed and abandoned more than three hundred years ago. From the bench in the foreground the emperor played parchisi,—his board, the pavement; his figures, slave girls

Buddhist temple bells no longer tinkle in the evening breeze.

Benares is on our way, and to visit it, is worth a long journey, even if one is not a pilgrim of the faith. To the Hindu, Benares has come to mean as much as Mecca means to the Mohammedan. We do not quarrel with the Hindu belief by saying Benares beggars description. Criticism is rather of the ignorance of the great mass of people who venerate the idols instead of treating them as symbols, as their faith teaches. The British long ago put

A human ant in the Himalayas.—With enormous weights balanced over the hips, the hill people trudge over mountain trails at elevations where walking is an uncomfortable exertion for a white man. One day Mr. Brown met a man carrying a pine log twelve feet long, squared eight by twelve inches

a stop to the practice of throwing baby girls to the alligators and burning widows on the funeral pyres of their husbands, but the burning ghats are always alight, for it is the desire of all Hindus to die and be burned here, their ashes to be scattered over sacred Mother Ganges. Golden temples; myriads of stone temples; masses of people bathing along the river and drinking the water, while now and then a half-charred corpse floats by,—such is Benares. A holy man sits on a pier all day, dipping up water with one hand, pouring it out with the other; another sits cross-legged on a bed of spikes. You look through a temple door and see a woman pouring milk over a lingam, the symbol of Siva; another anoints it with oil; still another drapes it with flowers. One leaves Benares without regret.

Agra, Delhi, and Lahore were cities of great importance during the Mogul periods, as they are today, and the marble buildings, mosques, and mausolea scattered through this section bespeak the splendor, wealth, and achievement of their builders. No monument in existence surpasses the Taj Mahal at Agra, mausoleum of Mumtaz, wife of the Emperor Shah Jahan; it is a lacework conception in marble, perfectly executed.

The palace in the fort at Delhi conjures up the thought of its great splendor when inhabited by emperors. Delhi, the present winter capital of India, is the seventh city of its name, and in the environs one may drive through forty miles of city potter's field. Mausolea and mosques in close proximity; cities of the dead and dead cities!

A few miles away lies Fatehpur Sikri, peopled by the ghosts of yesterday; a unique city of red sandstone buildings created and abandoned by Akbar more than three hundred years ago, but still in a perfect state of preservation as though the court had left but yesterday.

Simla, in the middle Himalayas, 8000 feet above the sea, is the summer capital, where duplicate copies of

important government papers are kept, so that only the personnel needs to shift, finding in either capital the data for conducting uninterruptedly the state business. Not until a summer is spent on the plains does one appreciate this advantage of migration. The higher Himalayas rise to the north in cold grandeur, but lack the majestic peaks seen farther east. Rickshaws and ponies take the place of carriages, while heavy loads are carried by the hill people,—an admixture of Tibetans and Nepalese. One marvels at the weights carried. Boxes, bales, huge building timbers, even pianos are transported by one man. Nothing seems to daunt these sturdy human ants.

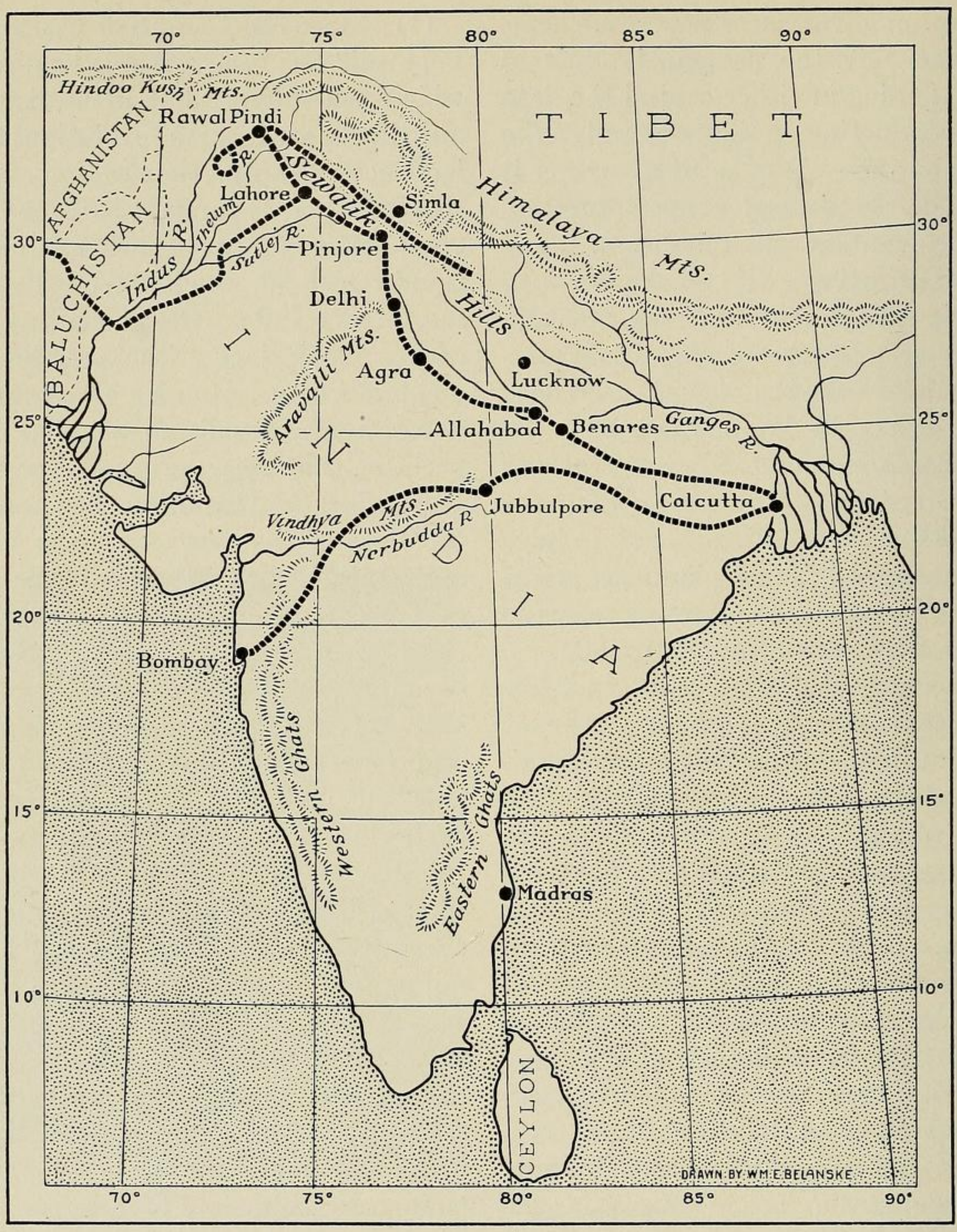
After a seventy-mile ride over low mountain ranges I joined Doctor Pilgrim in a government bungalow at Hari Talyangar, in the Bilaspur hill state. It was a pleasure to meet this distinguished gentleman who has done so much to unravel India's later geologic history. His hearty coöperation was assured, and it was of greatest importance to my work to be guided by his experience in determining characteristic rocks and their faunas, and to map out areas to be examined.

The journey across central India and along the lower ranges of the Himalayas affords a wonderful insight to its geology, the outstanding features of which are at once apparent. Briefly the Indian region may be analyzed as three distinct units: (1) a triangular mainland plateau named by the Indian geologists "the Peninsula"; (2) the mountainous region which borders it on the west, north, and east, called "the Extra-Peninsula"; and (3) the Indo-Gangetic Plain separating the two former areas. Stratigraphically and physiographically the first two divisions are entirely unlike.

(1) Since the Cambrian Period the Peninsula has been a stable land mass which has suffered but little disturbance in the great earth revolutions that have occurred from time to time. It is this part that is thought to be a fragment of a former continent called Gondwana land, which extended across the present Indian Ocean, uniting the Malay Archipelago with Australia and western Africa. Mantles of terrestrial deposits were locally distributed over parts of this area during the periods succeeding the Cambrian, and toward the close of the Cretaceous the south and central part of the Peninsula was covered by a thick series of lavas called the Deccan Traps. From the absence of craters and the horizontally-bedded sheets of material, it is evident that the eruptions came through fissures and cracks made by the movement of great earth blocks. Along the coast near Bombay the Traps reach a maximum thickness of nearly 10,000 feet and they encompass an area of 200,000 square miles, but formerly they covered an area estimated to be not less than 500,000 square miles.

Throughout the Peninsula most stratified rocks lie in a comparatively horizontal position, while mountain eminences are merely harder remnants of the surface that have resisted erosion. The rivers are shallow waterways meandering to the sea.

(2) The Extra-Peninsula, the Himalayan region, in contrast, is composed chiefly of marine deposits representing all the great geologic periods, including and succeeding the Cambrian; a comparatively weak, flexible area of the earth crust that has undergone an enormous amount of upheaval and compression during late geologic periods. All strata show high angles of dip, and extensive thrusts and faults



Map of India, showing the route of the Siwalik Hills Indian Expedition of the American Museum

attest the enormous strain to which these rocks have been subjected. The mountains are mighty serrated folds with deep transverse gorges; the rivers, rushing torrents. No less than nine of the great Himalayan peaks reach a height of more than 25,000 feet, Mount Everest, 26,002 feet, being the highest in the world. At one point in Kashmir the Indus rushes through a narrow defile between precipices 20,000 feet in height, while the river bed is only 3000 feet above sea level; thus this stupendous gorge is 17,000 feet, more than three miles, in depth.

(3) Between the Peninsula and the Extra-Peninsula lies the third great Indian feature, the Indo-Gangetic Plain, a sagging part of the Peninsula, or possibly an enormous rift fronting the Himalayas and filled in with river clays and silts that have been borne

down from the mountains by rivers tributary to the Indus and the Ganges. The abrupt termination of the foothills and the transition to far-reaching level plains in some parts of the Punjab, is startlingly sudden.

It is in this foothill region of rapidly accumulated deposits that our chief interest lies. Here and in the inlying Salt Range were preserved the remains of the varied Miocene, Pliocene, and Pleistocene vertebrate faunas.

Having just spent a year in Africa, sometimes near the equator, I rather pooh-poohed the suggestion that a white man could not work in the open the year round in India, so much farther north. Doctor Pilgrim, however, insisted that some parts of the Punjab were hazardous for a white man in summer, especially along the Indus, so I planned to spend the remaining winter months and early spring in the Bugti section of Baluchistan, and afterwards take up the Siwalik subdivisions in succession, reserving those of the highest elevation for the hottest weather.

I again proceeded across the northern part of India to Jacobabad, near the Bugti country, where first were found bones of the gigantic Miocene rhinoceros, *Baluchitherium*.

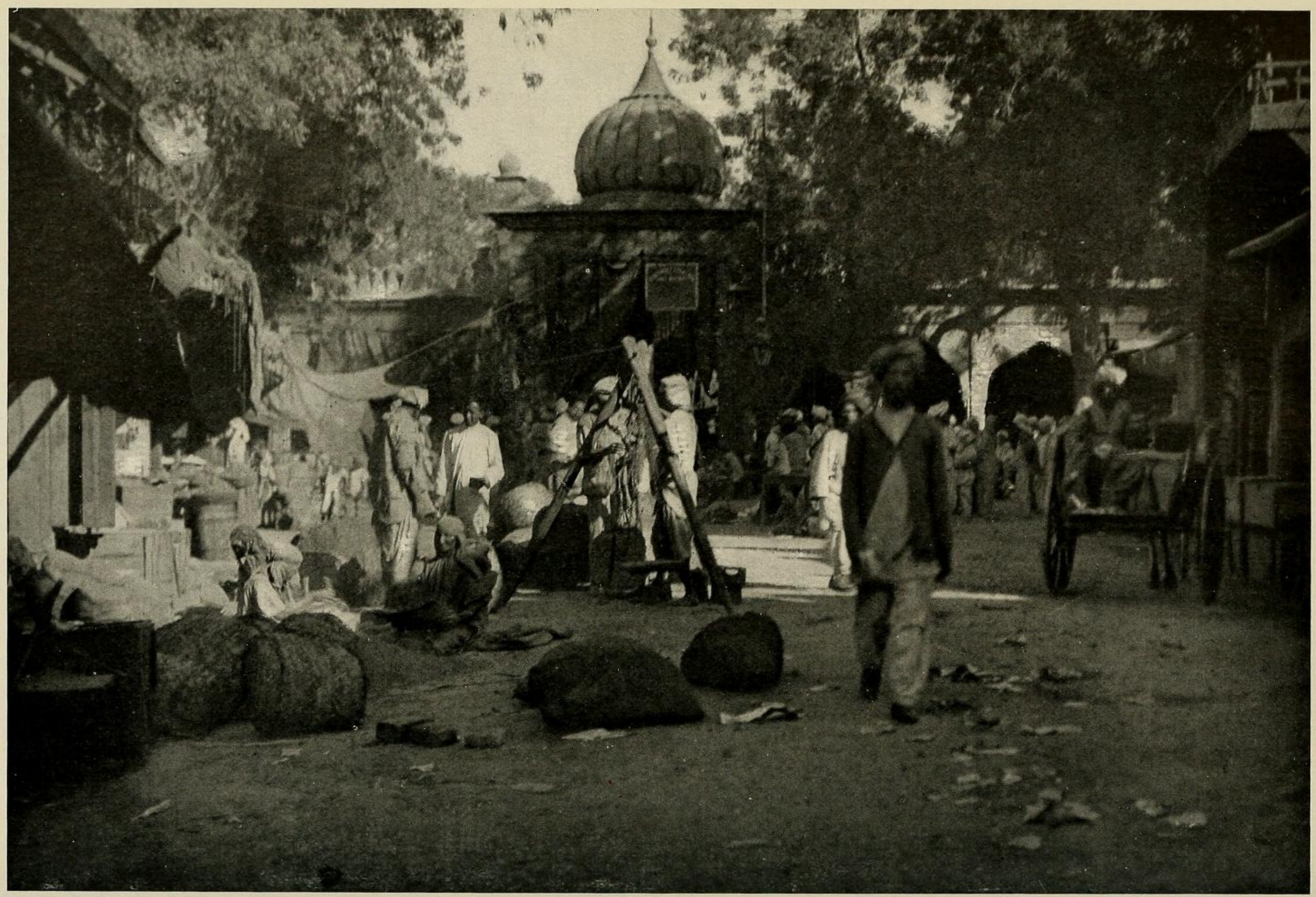
One always writes ahead for the use of a bungalow, and from the Sibi district came word not to leave for the field until I had seen the commissioner. Arriving at Sibi during a durbar I met the nawab of the Bugtis, who at first gave reluctant permission to work in his territory, provided I took a large armed escort. This agreed to, he later flatly refused responsibility. A year before an American oil geologist, with his party, had been murdered in his territory by raiding Pathans, for which the nawab was assessed 50,000 rupees, and he "didn't care to pay for another one."

I was loath to give up this part of the plan, but official correspondence with the government elicited no better results than permission to carry on the work at some future date. An expedition at the moment involved too many possibilities of a political nature.

Britain's suzerainty in India is held largely by her military administration, and her absorption of the borderlands is slow but sure. Highways and railways are built and maintained with military forethought. The borders of Afghanistan and Baluchistan on the northwest have long been the scene of conflict, for these untamed people do not take kindly to the assimilation process.

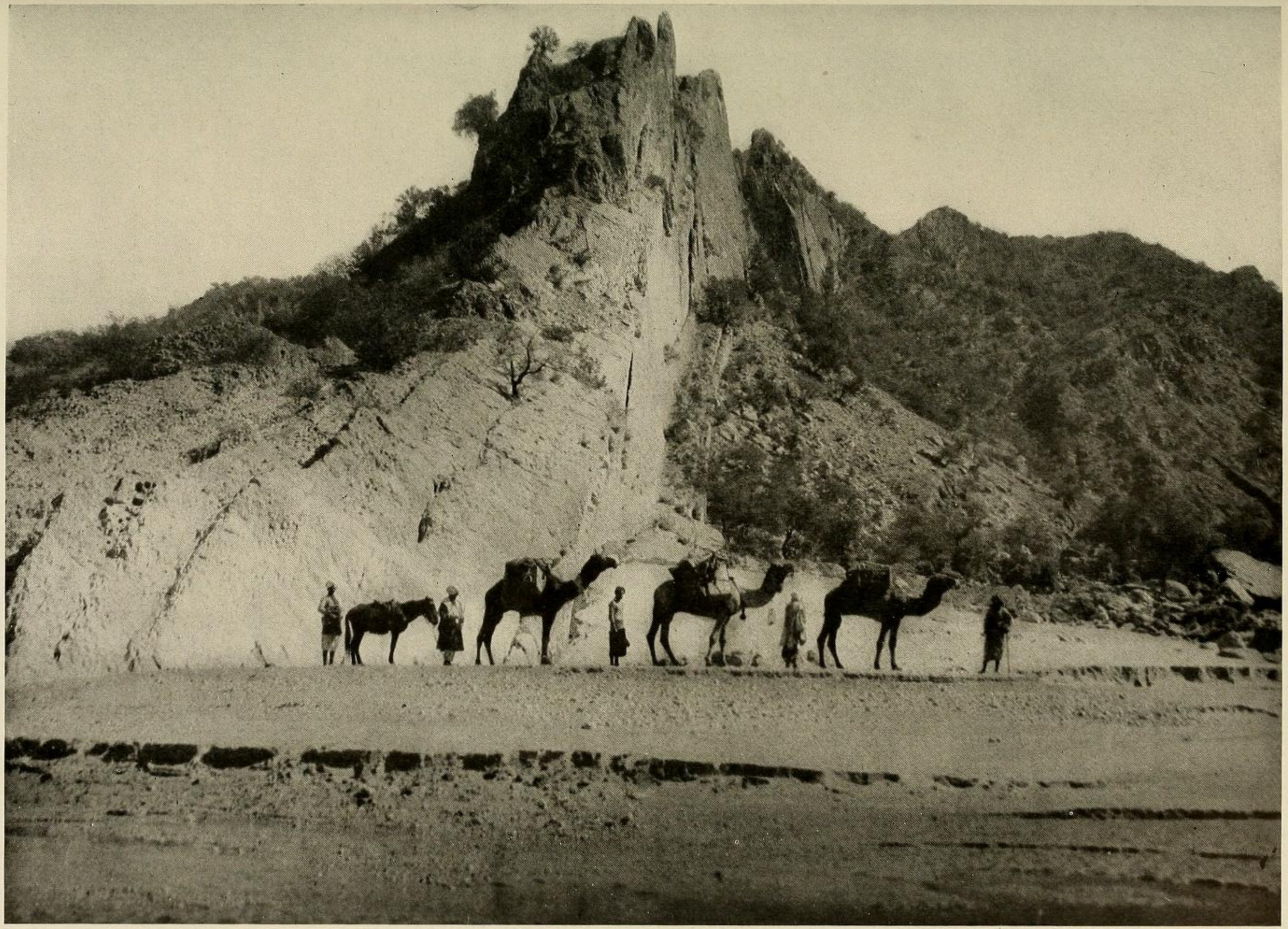
Jacobabad was long a frontier station, but now the military have moved westward, and the surrounding country is under irrigation, with ditches fed by the Indus. Magnificent neem trees contrast with the sandy desert outside, and the crops show the great possibilities of irrigation. Fat sheep and cattle and swift Arab-bred horses were a welcome sight after the underfed animals of other parts. Even the people reflect their improved condition, aside from the fact that the Baluchis and Afghans are more virile than the central Indian peoples. Temperature charts kept over a long period at this point record a usual maximum summer heat of 129 degrees. It is one of the hottest places in the world, although at the time of my visit in March it was delightfully cool.

Back I traveled to the northern sections; from Rawalpindi it was but a short distance to Chakwal, where a camel caravan was gathered for my three journeys to the Lower and Middle Siwalik exposures of the Salt Range.



THE MARKET PLACE IN JACOBABAD

The distinguished British general, John Jacob, for whom the town was named, spent many years quelling anarchy in the Upper Sind, built the Residency, and here lies buried under a massive tomb



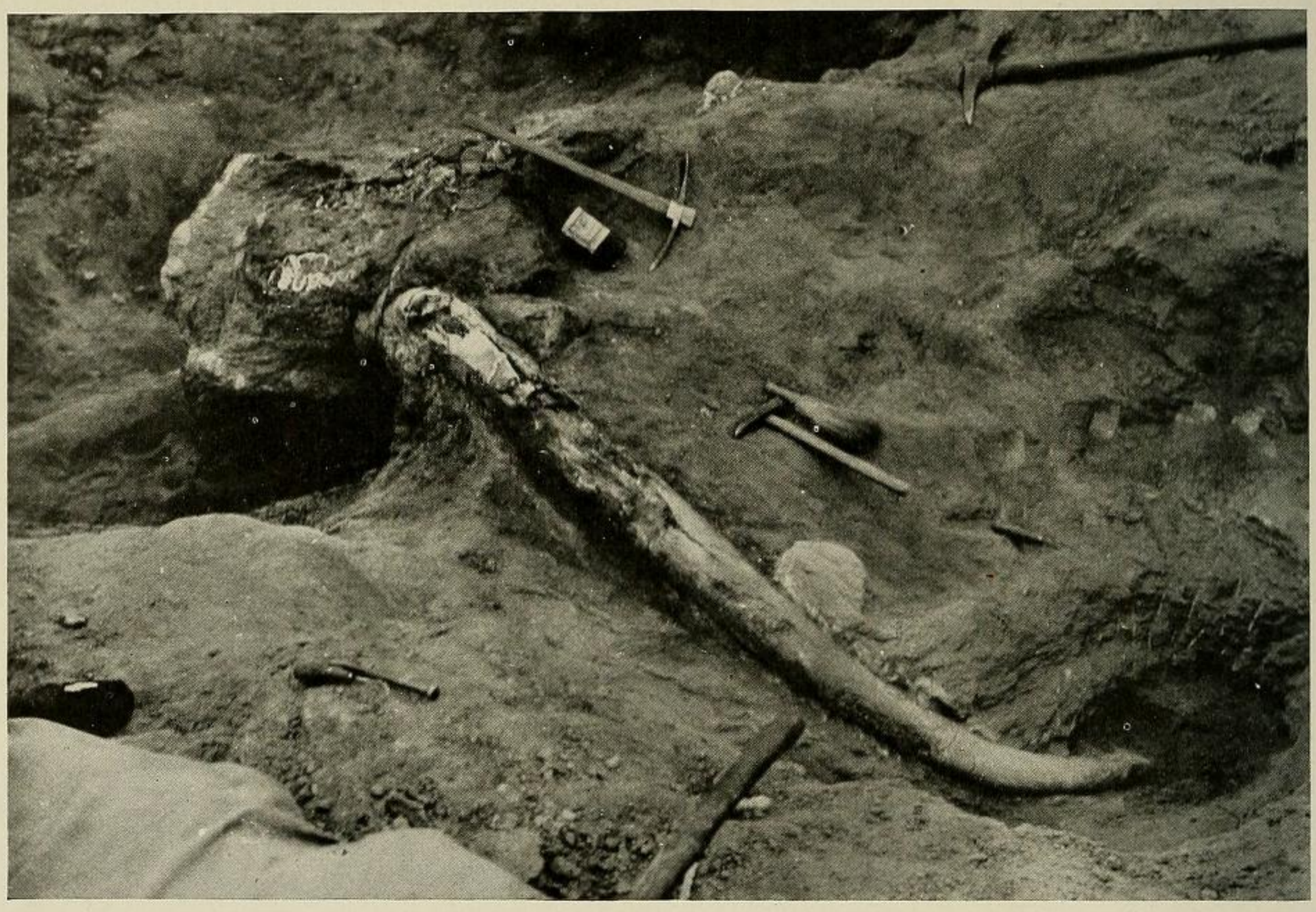
THE CARAVAN OF THE EXPEDITION IN THE DILJUBBA RUKA PASS

For many miles east and west the range can be crossed only at this point, where the rock strata stand on edge

The Chakwal region was then suffering from an epidemic of bubonic plague. At such times the villagers scatter to the country, living along the trails wherever shelter is afforded.

As one journeys southeastward, the trail winds through cultivated lands, and through the pass of the Diljubba Ruka Hills, where several hundred feet of variegated marine rocks underlying the Siwalik strata are exposed. At Hasnot the broken country assumes a lighter orange-buff color, and in the surrounding exposures have been found many fossils of Middle Siwalik age. The ground had been worked over not long before, and fossils were not nearly so numerous as they doubtless were originally. However, skulls and jaws representing a large part of the fauna were obtained, chiefly of the smaller forms. Satisfying myself that this area had little more to offer, I proceeded northward a hundred miles to the Soan River, a second well-known area of Middle Siwalik exposures near Dhok Pathan.

The weather had now become excessively hot, and I was grateful to be permitted to live in a government dak bungalow, an institution worthy of mention. Throughout India, and to some extent in Burma, various government departments, such as the Police, Public Works, etc., have built bungalows at points convenient for the traveler. Some are fine, costly buildings, furnished throughout and, where use demands, frequently comprising from one to six complete separate suites. By arranging beforehand any civilian may obtain permission to occupy one of these suites for a limited stay at a regulated small charge, usually one rupee per day (about thirty cents).



A large *Mastodon* skull in situ.—Specimens of this size were guarded from the natives night and day

Some of the best fossils were found at Dhok Pathan, including horse and

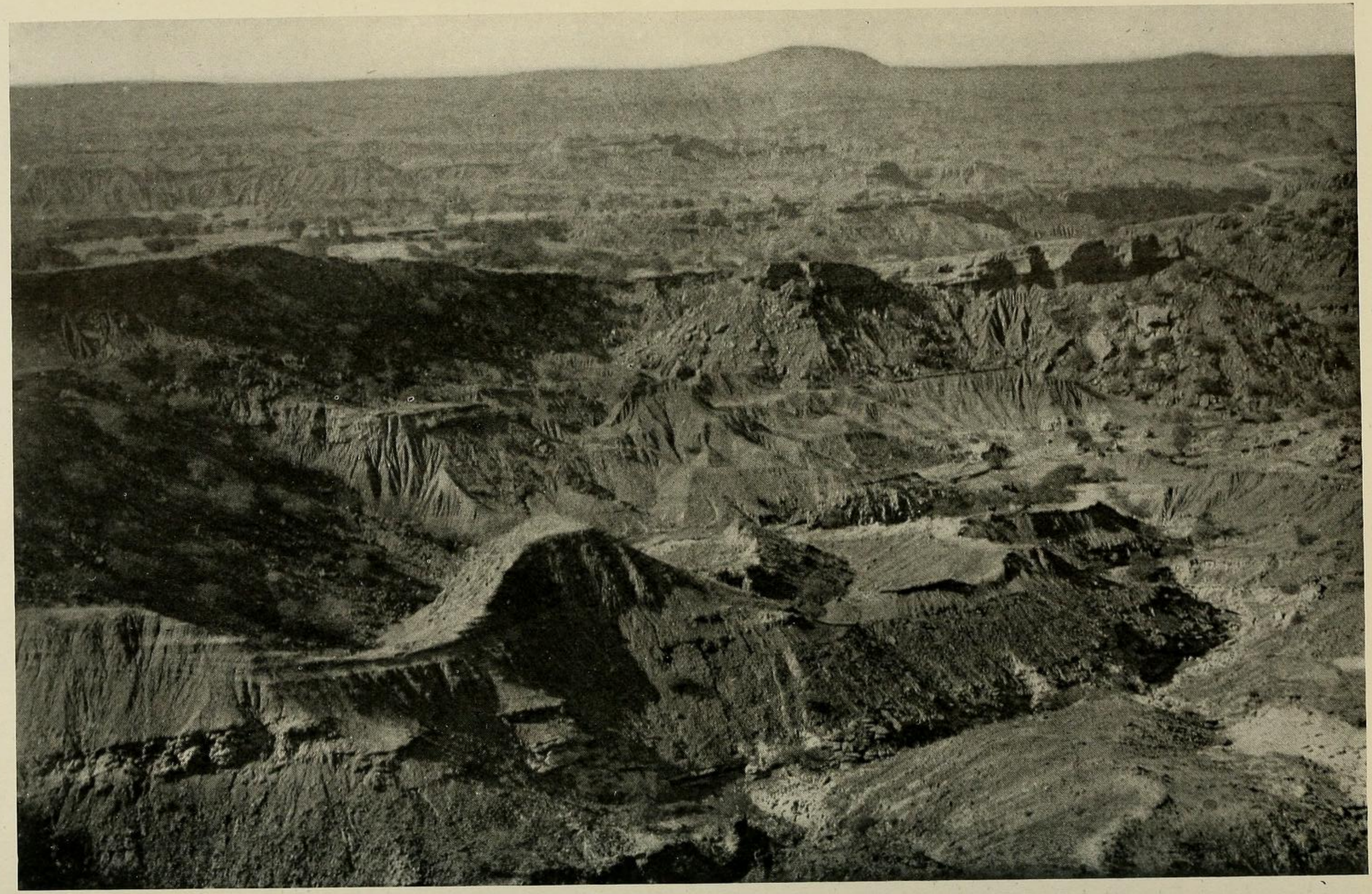
The big mastodon skull starts west at last.—It took four bullocks and twenty-one men fourteen days to "worry" it to the railway, sixty miles away

Mastodon skulls, the latter presenting no inconsiderable difficulties to transport. Camels are wonderful beasts for carrying loads up to six or eight hundred pounds, but a fossil elephant or *Mastodon* skull far exceeds their capacity. Due to the rough country two of these skulls were exceedingly difficult to bring out, each requiring four bullocks to pull, and twenty-one men to push the cart in which it was conveyed after a road had been made for several miles.

The only oil so far produced in India, a limited supply, comes from the Orbitoidese measures underlying the Lower Siwaliks at Khoar, a few miles northward.

Further search at Dhok Pathan added nothing new to the collection, which now included most of the known species, and I proceeded southward to the Lower Siwalik exposures at Chenji. These strata are predominantly reddish in color, and very broken, with fossils most abundant in two upper zones stratigraphically several hundred feet apart. Vertebrate remains, however, are found occasionally down almost to the point of contact of these strata with the underlying marine beds. The strata gradate into overlying Middle Siwalik sandstones without sign of interruption in their deposition. Few of the species are common to the overlying sandstones, but after some little experience in the field one can readily distinguish the two horizons although there are no lithological characters to separate them.

The natives cultivate patches all through the exposures and they rather resented the activities of a Sahib who went out to find fossils himself; consequently a guard had to be placed over every large specimen that required more than a day to excavate. No matter how rugged or difficult the place, I would soon see spectators perched on the high peaks, where they would remain for hours. In spite of explanations the natives could not understand why bones were collected for a museum. When asked one day what they supposed the Sahib did with

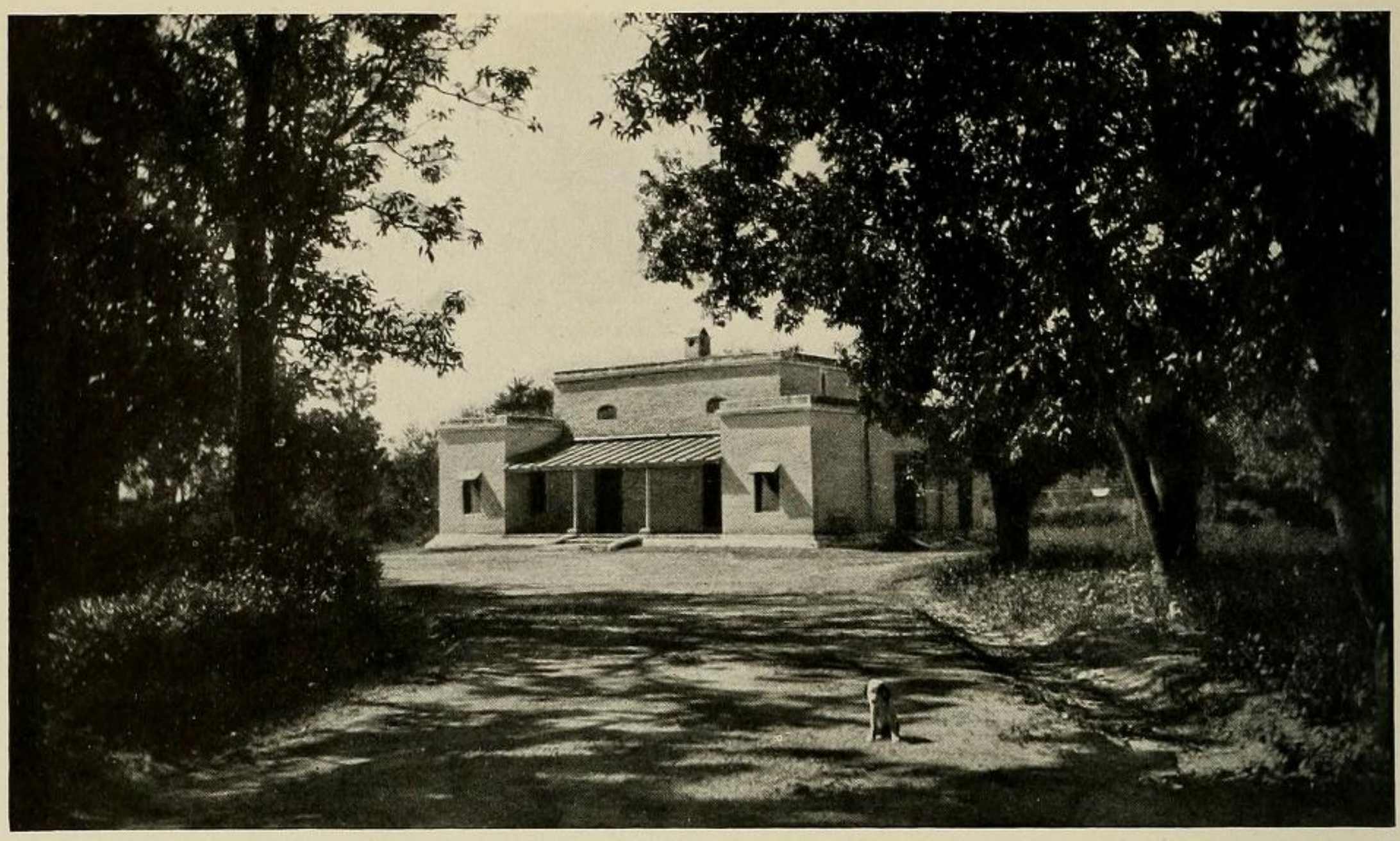


LOWER SIWALIK BEDS NEAR CHENJI

In appearance the Lower Siwaliks are not unlike bad lands in other parts of the world but are easily distinguished by their reddish appearance and fossil remains from the overlying Middle Siwaliks. Every available level place, even in this wild region, is cultivated

TOP OF THE UPPER SIWALIK BEDS AT SISWAN

Toward the close of the period represented by these beds there was accelerated elevation of the Himalayas, marked by predominant bowlder and conglomerate strata clearly shown in this photograph. Few fossils are found in these strata



Public Works Department bungalow at Chandigarh.—In the early days of British administration, a departmental officer required a cumbersome outfit of tents and caravan with two complete equipments, so that whenever one camp was abandoned, another might be in readiness for him. Now fine bungalows are built at convenient points

these bones, they replied that he pounded them up for medicine—a prevalent use of fossils also in parts of China.

Having completed this part of the program, I proceeded by rail to the Upper Siwalik exposures in the Ambala district, near Kalka. It was in this area that Siwalik fossils were first found, and for many years thereafter fossils from the three divisions of the Siwaliks were grouped under the same time period, without recognition of the significance of evolutionary development in various genera.

One may better appreciate what this means from the fact that taking the places of maximum thickness of each member, the three subdivisions total 20,000 feet of sediments,—strata that are especially difficult to classify and correlate on lithological characters without the aid of fossils. This enormously thick mass of strata does not, however, represent the same time period that an equal thickness of rock would denote elsewhere. The deposition of the beds was more rapid than that traceable in almost any other part of the world. Especially is this true of the Upper Siwaliks, where hundreds of feet of material are composed chiefly of bowlders rapidly accumulated during a period of elevation of the Himalayas. The thickness and character of the beds are explained by the height and broken nature of the mountains from which they were derived, in conjunction with the excessive rains which fall during the monsoon periods, when every water course is a muddy torrent. Micaceous material from disintegrated schistose rocks forms a large percentage of the entire Siwalik series.

The Upper Siwalik beds usually form the outer range of the Himalayas as distinct low ridges parallel to the main range, or at intervals as part of the outer flanks of the range extending from

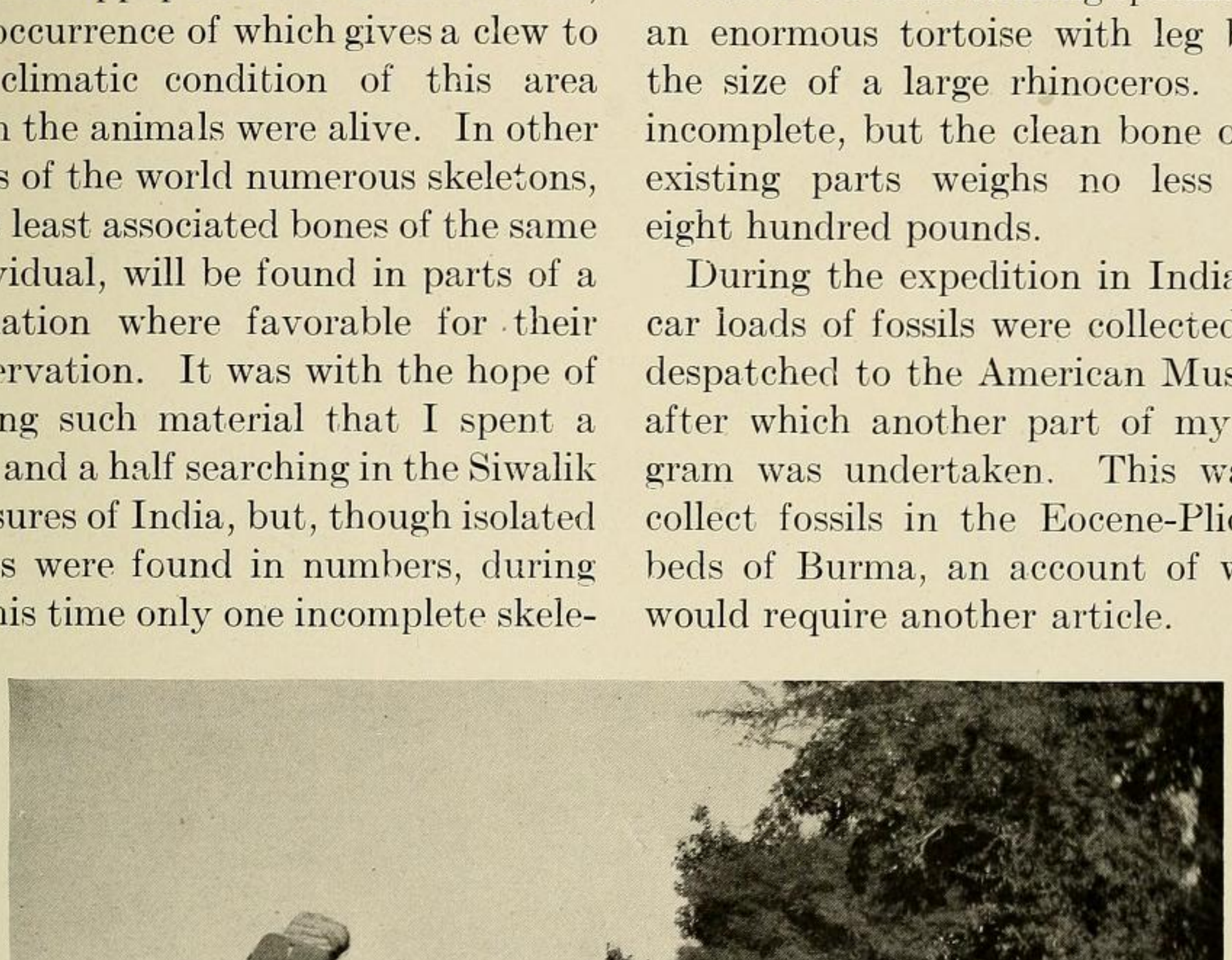
Baluchistan to Assam. They are not, however, fossiliferous throughout their extent. One of the historic type localities is on the railway to Simla, near Chandigarh, where I made headquarters in a dak bungalow, collecting on either side along the foothills for a distance of seventy-five miles.

In the Upper Siwalik fauna elephant remains are most numerous, with those of hippopotamuses a close second, the occurrence of which gives a clew to the climatic condition of this area when the animals were alive. In other parts of the world numerous skeletons, or at least associated bones of the same individual, will be found in parts of a formation where favorable for their preservation. It was with the hope of finding such material that I spent a year and a half searching in the Siwalik measures of India, but, though isolated bones were found in numbers, during all this time only one incomplete skeleton, that of a camel, was secured in the Upper Siwaliks.

The faunas of the different Indian horizons are represented in the collection of the Siwalik Hills Indian Expedition of the American Museum by skulls or jaws of most of the known species and by several new species; the collection is especially rich in skulls and jaws of elephants and horses.

One of the most striking specimens is an enormous tortoise with leg bones the size of a large rhinoceros. It is incomplete, but the clean bone of the existing parts weighs no less than eight hundred pounds.

During the expedition in India two car loads of fossils were collected and despatched to the American Museum, after which another part of my program was undertaken. This was to collect fossils in the Eocene-Pliocene beds of Burma, an account of which would require another article.



Elephant skull found at Siswan in a hard sandstone concretion of the Upper Siwalik beds.—Mohammedan masons are helping to remove the matrix