An independent forest seed laboratory might well be located at one of the existing forest experiment stations or at the Forest Products Laboratory, Madison, Wisconsin.

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A BIT OF ILL-CONSIDERED CONSERVATION LEGISLATION

FOR some obscure reason, when bills are being framed for submission to legislative bodies, expert advice as to plant names is usually not obtained. Every few years some organization or other sends a bill to Congress to make a certain plant the national flower of the United States, and in every case in which a copy of such a bill has come to the attention of the writer, the scientific name of a foreign plant has been attached. Thus the columbine bill specified *Aquilegia vulgaris,* which is the European species; and the daisy bill *Bellis perennis,* the English daisy. Fortunately all such bills have been referred to the Committee on Library and have never been reported out.

The states have not fared quite so well, however. Not only have several of them designated as state flowers weeds introduced from other countries, but one, Minnesota, once officially selected for its emblem *Cypripedium calceolus,* the European lady-slipper, which does not grow in that state, or, for that matter, in any part of the United States.

Conservationists have now started similar activities. On May 18, 1935, the Senate and General Assembly of the state of New Jersey enacted that "It shall be unlawful to take for the purpose of sale, sell, or expose for sale, any wild *solanum dulcamara,* commonly known as bittersweet. . . ." Actually the plant designated is a weed of waste places, the destruction of which should be encouraged because it harbors potato-beetles and other pests; and it wilts too quickly for any one to bother to sell it anyway. Had the backers of this legislation only sought a little expert advice, they would have learned that the name of the plant they really wanted to protect was *Celastrus scandens.*

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JOINT GEOLOGICAL AND PREHISTORIC STUDIES OF THE LATE CENOZOIC IN INDIA

Two previous expeditions to the Northwest-Himalaya had given de Terra sufficient geological data to show that Kashmir and the adjoining plains of the Punjab would yield important information on the relationship of glaciations and crustal movements to early man and his cultures. Scattered finds of some Paleolithic artifacts and evidences for Pleistocene and subrecent mountain uplifts which he had collected in 1932 seemed promising enough as to warrant a special study of this subject.

The Carnegie Institution of Washington and the American Philosophical Society at Philadelphia most generously granted most of the funds necessary for carrying out a program of research in which several institutions cooperated. Foremost amongst these was the Royal Society and Cambridge University, who enabled Paterson to collaborate, and Yale University. The Geological Survey of India, by kindness of its directors, Sir Leigh Fermor and Dr. A. M. Heron, lent the valuable assistance of Mr. N. K. N. Aiyengar, whose task was not only to gather additional fossil material of the Siwalik fauna, but especially to collect fossil primate remains. The expedition leader asked Dr. P. Teilhard de Chardin, of the Cenozoic Research Laboratory in Peiping, to participate, and his association, which lasted shortly over three months, was of the greatest assistance. Mr. D. Sen, of Calcutta University, acted as field assistant, and temporarily Mr. H. J. H. Drummond and Mr. Krishnaswami associated themselves with our party.

Naturally the investigations had to be based on a careful stratigraphy of the Pleistocene. The glacial cycle in Kashmir, which, in a general way, had previously been recognized by Giotto Dainelli, provided an ideal means by which it was possible to work out a standard sequence of geological events for the mountainous tract. Such data could then be used in correlating the late and post-Siwalik formations of the adjoining foothills and plains with the glacial and interglacial deposits in the north. This in turn would enable us to date any prehistoric cultures found *in situ,* and also to check the stratigraphical results thus gained against the paleontological records on which had previously been based the stratigraphy and age of the Siwalik formations.

The work in Kashmir was carried out in this way, that Paterson undertook a survey on the Himalayan slope of the Kashmir basin, and in the foothills of Poonch, while de Terra studied the basin filling and the southern flank along the Pir Panjal down to the plains at Jammu. Pleistocene geology centers here around the glacial cycle. Its evidences were found in the morphology of the glaciated valleys and in the sedimentary records of both glacial and interglacial stages.

Composite valley slopes clearly revealed the scooping effects of at least three different periods of valley glaciation and they also showed that the respective valley floors of the various glaciers had successively been eroded by streams with strong erosional power. This intense erosion mainly took place during the first and second interglacial periods, at which time the drainage experienced rejuvenation due to uplift. A set of five terraces permitted us to recognize the effects of this glacial cycle even at places where typical moraine deposits are missing, but in the valleys the terraces are always connected with the three last ice advances and the respective interglacial periods. The topmost terrace was found cut into the moraine and outwash deposits of the second glaciers, and for various reasons it must be of second interglacial age. The lower terraces (2, 4, 5) are made of boulder gravel belonging to the outwash activities of glacier streams of the third, fourth and fifth ice advances. Terrace 3 was seen to cut into the morainic debris left by the third glacier and therefore should belong to the third interglacial.

The various terminal moraines, however, form the strongest evidence for the glacial cycle. Their position in the valleys is such that the lowest (at 5,400 feet) marks the first and oldest, and the highest (at ca. 9,000 feet) the youngest of the ice advances. The moraines of the second glaciers were deposited into a lake and are therefore represented in the form of boulder conglomerates and a "boulder clay" which separate the lake beds of the first and second interglacial period. This lake filled the Kashmir basin and the valley outlets and it existed from the first until the beginning of the second interglacial. This dating became possible only after a thorough mapping of the valley outlets was made where the lake beds overlie the lowest moraines and the oldest fluvio-glacial outwash gravels. The first interglacial thus was recorded through deposition of the "lower Karewa lake beds," which de Terra found to be highly fossiliferous at many places. With the kind assistance of Dr. R. Stewart, of Rawalpindi, and Aiyengar, some 800 fossil plant specimens were collected and in addition fish and mammalian remains (*Elephas namadicus, Cervus*). The flora is at one place characterized by the prevalence of pine and oak, at another by the combination of birch, beech and willow, which would indicate a cold temperate climate. Plant-bearing lake beds were even found on the crest of the Pir Panjal range at 11,200 feet, to which height they can only have been carried by continuous uplifts which occurred during the three interglacial periods. On the Kashmir side these lake beds are unconformably overlain by ground moraines and redeposited morainic outwash of the second glaciers. In the mountains large glacial trough-valleys and thick moraines testify to the intensity of the second glaciation. The latter was preceded by strong uplift and folding of the lower Karewa beds, which took place at the close of the first interglacial. The upper Karewa beds consist of the glacial conglomerates and overlying lake beds, and both were folded in connection with another uplift of the Pir Panjal range, which event presumably caused the lake to be drained off through the Jhelum valley. Subsequent erosion was very intense and into the newly carved relief advanced the glaciers of the third glaciation. Because of the steep valley gradients these glaciers attained in the Pir Panjal such momentum that they descended farther into the lowlands than the glaciation would normally have admitted. They left sets of terminal moraine walls which generally consist of from 3 to 4 moraines. The fourth and fifth ice advances left moraines 2,000 or 4,000 feet, respectively, below the limits of present glaciation.

These data, which permit of recognizing a glacial cycle and its dependence on contemporary diastrophism, provided us with a key to the understanding of the late Cenozoic history in the adjoining foothills and plains.

Along the Tawi River in Jammu de Terra observed that the ground moraines of the second glacier gradually merged into the "Boulder Conglomerate" of the Upper Siwalik group, which here contains faceted boulders. Paterson independently found the same relationship in Poonch. Through this principal fact the late Siwalik history of the Himalayan foothills became linked with the glacial cycle. A joint excursion to the Pleistocene basin of Campbellpore, near the Indus below Attock, revealed that the "Boulder Conglomerate," which here contains erratics, unconformably overlies a tilted series of conglomerates, sandstone and brown- and orange-colored silt or clay. In its upper portion this series contains a rich vertebrate fauna in which *Equus, Bos, Bubalus, Cervus, Felis, Hyaena, Stegodon* and *Elephas* figure prominently. This fossil association indicates an early Pleistocene time of presumably Pinjaur age. The basal layers recall the composition of the Upper Siwalik "Tatrot stage." Teilhard and de Terra took occasion to study this stage in numerous exposures, as at Tatrot, Bhaun, Dina and in the Soan valley, while Paterson surveyed it in Poonch and Mirpur. They received the impression that the Pleistocene generally began with a differentiation of the relief into single basins, in which the Tatrot-Pinjaur series unconformably overlie the Dhok Pathan rocks, while the "Boulder Conglomerate" everywhere covers the folded early Pleistocene beds. It is this composition and structure which the Punjab sequence has in common with the Kashmir Pleistocene.

In the Potwar region near Rawalpindi and in Poonch the second glaciation was followed by a long erosional interval which in turn gave place to the deposition of a thick series of loess-like silt and clay. This Potwar formation covers the older relief with its fluvial and lacustrine sediments into which terrace 3 was cut during the third interglacial. This observation induced us to date the Potwar silts as third glaciation.

In the Pleistocene between the Salt Range and the Indus Valley we found numerous prehistoric cultures. Large waste flakes were found in the "Boulder Conglomerate" in a worn state. The oldest definite industry, however, consists of a series of massive choppers, scrapers and hand-axes which seem to be ancestral to a middle Paleolithic industry discovered by de Terra on the Soan River near Rawalpindi. Because of its distinct facies he has called it the "Soan industry," and related industries ranging from the beginning of the second interglacial into the third glaciation will probably constitute a definite Soan culture. Associated with the earlier Soan industries are rolled Chellean and Acheulean bi-faces and cleavers, and it would seem that the Soan culture extends in prehistoric chronology from Chellean to upper Paleolithic, the latest industries being very reminiscent of the Asiatic Aurignacian of Europe, as pointed out by Drummond. The wide-spread occurrence of this culture along ancient drainage channels suggests that the Soan people utilized the valleys for their migrations, and the peculiar character of their implements perhaps may indicate a people distinct from that of the Acheulean core-tool manufacturers of southern India.

The Neolithic in the Punjab is represented by stray samples of "celts" and tools of soft sandstone. A megalithic culture was unearthed in Kashmir, where the expedition leader undertook a trial excavation which brought to light a number of polished greenstone axes, knives and bone implements. In association with these appeared a very primitive type of handmade pottery with nail marks and grass-matt design which antedates a black burnished ware that also occurs in the lowest layers at Mohenjo Daro (Upper Sind). Paterson also found the same type in a midden in the Sind valley. This pottery may be associated with the megalithic culture, and it appears to represent a very ancient Indian civilization.

In order to enlarge and test our opinions on Pleistocene stratigraphy and prehistory in India, we used the last month for a visit to various places of interest. The first two authors went to Upper Sind and then to the Narbadda valley in Central India, while Paterson and Drummond visited the museums at Lahore, Benares, Calcutta, Trivandrum, Colombo, Madras and Bombay, field work being carried out in the last two districts. At Rohri and Sukkur in Sind were found a variety of rich workships of Acheulean-, Soan- and Neolithic peoples. The tools are well worked in flint, but almost all were found on the surface, as remnants of Pleistocene deposits are scanty. In the Narbadda valley, however, fresh and rolled Acheulean implements were found in association with the Narbadda fauna, of which we collected *Equus namadicus, Bos namadicus, Bubalus, Cervus, Hippopotamus* and other forms. Here the early Paleolithic industry occurs in a lower group of conglomerates, sands and clays which we are inclined to equate with the "Boulder Conglomerate" stage. Some Soan industries appear in the upper group in association with the same fauna and rolled early Paleolithic tools. A great disconformity separates both groups, of which the upper one is most probably homotaxial with the Potwar silts of the Punjab. A Chellean workshop was found near the rock shelters of Hoshangabad, where prehistoric paintings occur.

In the museums mentioned above the collections showed a wide-spread occurrence of a primitive and proto-Neolithic culture which may be derived directly from the upper Paleolithic, of which only the Soan facies seems to be at all prominent, the European and African types being almost completely absent. The early Neolithic is akin to that of northern Europe, though there occur types similar to the latest upper Paleolithic of North Africa. An extensive microlithic industry, generally in semi-precious stones, was studied.

In Madras the great mass of the low-level laterite seems to have been deposited on a conglomerate or an associated sandstone or grit, which, according to the prehistoric remains, may be equated with the "Boulder Conglomerate" of the Punjab. The mixture of industries and cultures in the laterite is attributed to subaerial washing and rewashing of the laterite and the gradual burial of the artifacts. Three terraces were observed, the upper two of which can probably be assumed to be of the same age as terraces 2 and 3 of the Punjab by reason of the Soan industries found in and on them. Several very rich sites were found, and in most cases the Soan culture predominated. The accurate dating of the latter in the Punjab will be of great assistance in a study of the Pleistocene throughout India, for, as the museum collections show, this culture occurs in most regions between South and North India. At Khandivli, near Bombay, an implement-bearing site discovered by Lt. Todd, R.I.M., showed a subaerial deposit alike in age to the laterite of Madras. Gravels carrying later Soan industries, and clays which may be homotoxical with the Potwar, overlie this earlier deposit.

Aiyengar's fossil collecting in the Salt Range, in Jammu and in the Simla Hill states resulted in a good representative collection of Siwalik fossils. Amongst these a substantial collection of fossil primate remains will make a welcome contribution to the present scanty knowledge of this higher anthropoid group.

Most of the fossil material was sent to the United States for investigation, while the prehistoric material, numbering some 4,000 specimens, was placed under the care of Paterson at the Archaeological Museum of Cambridge University. It is planned eventually to distribute the collections between Yale and Cambridge Universities and the Indian Museum in Calcutta.

H. DE TERRA,
Leader of the Expedition
P. TEILHARD DE CHARDIN
T. T. PATERSON

SCIENTIFIC BOOKS

SANITARY ENGINEERING

Elimination of Taste and Odor in Water. By JOHN R. BAYLIS. pp. x + 392, 85 figs. in text, 88 tables, chapter bibliographies, index; 9 by 6 inches. McGraw-Hill Book Company, Inc., New York and London. 1935. $5.00.

FOUR national engineering societies, the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and American Institute of Electrical Engineers, have made arrangements for the production of books adjudged to possess usefulness for engineers or industry, but not likely to be published commercially because of too limited sale without special introduction. The first of these Engineering Societies Monographs is written by the physical chemist of the Division of Water Purification of the Bureau of Engineering, Department of Public Works, of the City of Chicago.

The esthetic qualities of potable waters reside not only in their color and clarity but also in their freedom from objectionable odors and tastes. These last-named qualities have various origins. Many have a natural origin, either organic or chemical, while others arise from industrial pollution which in turn may combine with, increase or decrease those occurring in nature. The author lists thirty-six adjectives descriptive of tastes and odors, twenty of which are traceable to organisms. These are mainly synthetic green algae, blue green algae, diatoms, colored flagellates and plants which may produce volatile essential oils; or more rarely molds, bacteria and occasionally microscopic animals of the plankton or larger attached animals, such as sponges and bryozoans in water mains. The death of plankton organisms occurs in distributing systems, and their decay is rapid because of the ratio of their surface to their volume. Their numbers per cubic meter in reservoirs are subject to the rhythm of seasonal and photic fluctuations and they multiply a hundred fold or more in a very short time, thus giving rise to sudden flares of quite perceptible odors and tastes, some of which are esthetically objectionable. No water supply exposed to light escapes this organic source of odors and tastes.

Chlorination of water supplies before admission to the water mains for the removal of the possibility of contamination with pathogenic bacteria often leaves a chlorinous taste in the water at the faucet. Few, if any, streams escape industrial and sewage pollutions, some of which persist for a long time with little change except by dilution.

The sanitary engineer who seeks to maintain a municipal water supply in a uniform state of minimum odor and taste may prevent some invasions by inspection for pollution, by treatments with copper sulfate or chloramine to destroy algal growths, by precipitation and filtration to remove substances and organisms from the water, but any one or even all of these treatments are inadequate to insure continuous freedom from objectionable tastes and odors. The engineer therefore is compelled to seek some easily operated system, using inexpensive materials not subject to quick exhaustion which will uniformly remove the exceedingly varied chemical substances from the water before it enters the water mains. This book explains the use of activated carbon for this protean task.

The first chapter deals with the sources of odors and tastes and the methods of their detection and quantitative measurement. The apparatus for detecting odors in cold and hot samples by seriated dilutions with standard odorless water are elaborate and ingenious. It seems probable in the light of known variations in the sensitiveness of the individual and the amplitude of individual variations among different observers that both qualitative and quantitative variations will somewhat reduce the comparative values of such tests. If applied uniformly by a single observer of proven sensitiveness to slight differences in amounts of the various substances concerned, these tests may, however, have a high practical value in regulating the processes of control by the methods described in this book.

The industrial uses of activated carbon are an indirect result of the use of irritating and lethal gases