organizing the exhibit, the museum has been aided by the Thomas Alva Edison Foundation and a number of leading industrial concerns.

Museum News reports that deeds have been accepted by the Secretary of the Interior to 22,817 acres and surface and cave rights to 4,743 acres of the Mammoth Cave area, sufficient to give it National Park status. The deeds were turned over to the Government by the Kentucky National Park Commission. Recreational development of the new park will await the acquisition of a major portion of the remainder of the authorized maximum of 70,618 acres.

AT a recent congregation of the University of Oxford, Sir Farquhar Buzzard, Regius professor of medicine, introduced a statute creating an Institute of Experimental Psychology in the university. He said that the need for such a foundation had long been felt, and a committee of the General Board drew up seven years ago a report, which the council approved but could not put into effect because of financial stringency. An anonymous donation of £10,000 and an allocation from the Rockefeller trustees of £500, together with £150 per annum for the next five years have been received. Under the terms of the donation the first director of the new institute would be the Wilde reader in mental philosophy, Dr. William Brown.

FIVE South African mining and finance houses, the Anglo-American Corporation of South Africa, the Central Mining and Investment Corporation, the Consolidated Goldfields of South Africa, the New Consolidated Gold Fields and the Union Corporation have each made a donation of £1,000 to the Cavendish Laboratory to be devoted to any purpose of the Cavendish Laboratory which those in charge of the administration may decide.

THE general board of the University of Cambridge proposes to establish a post of assistant director of research in medicine. He will work in Addenbrooke's Hospital and the laboratories of the university under the direction of the Regius professor of physic, and if the university approve the proposed post the appointment will be for an initial period of three years at £700 a year.

THE twenty-fifth annual report of the Brooklyn Botanic Garden, for the year 1935, comprises a brief survey of the first quarter century of the garden. During this period the City of New York has appropriated a total amount of $2,039,664 for permanent improvements and maintenance, and the Board of Trustees has provided private funds amounting to $1,618,056 for the same purpose. The contract between the city and the board obligated the board to provide only $50,000 of private funds. During 1935 the board of trustees provided nearly 52 per cent. of the maintenance budget so that the city, as the report points out, secured two dollars worth of public service for every dollar it appropriated. The total registered attendance for the year exceeded 1,624,000, with a record week-end attendance on May 11 and 12 of more than 43,000. The attendance at regular Botanic Garden classes was nearly 66,000 and visiting classes from city schools of more than 49,000. Thirty-three pages of the report are devoted to summaries of the research work of the garden's personnel for the year. Plant material was supplied to 10,891 teachers in 297 schools and colleges in all five boroughs of Greater New York for the instruction of 470,855 students. More than one million packets of seeds were supplied to school children for the planting of school and home gardens. Reports of progress in research projects are given as follows: Plant pathology, leguminous tubercles, types of algae, regeneration and polyploidy, iris, forest pathology (chestnut blight), systematic botany, coffee and tobacco pharmacology.

DISCUSSION

ORIGIN OF THE SUPPOSED METEORITE SCARS OF CAROLINA

THE Coastal Plain of the Carolinas and northeastern Georgia exhibits a vast number of elliptical depressions partially surrounded by rims of sand. Such depressions, as well as others more irregular in form, are locally called "bays." Attention was first directed to their peculiarities some forty years ago by Glenn,[1] but not until Melton and Schriever[2] ascribed to them an extra-terrestrial origin did they attract wide popular as well as scientific attention. The two authors last named, in a paper giving an excellent account of the major characteristics of the bays, advanced the hypothesis that the oval depressions were produced by the impact of a great shower of meteorites. It was suggested that the meteoritic shower may have represented the nucleus of a comet which collided with the earth and that the direction of approach was from the northwest.

C. Wythe Cooke,[3] Erwin Raisz,[4] Fletcher Watson,

[1] L. C. Glenn, SCIENCE, n. s., 2, 472–475, 1895.

[2] F. A. Melton and William Schriever, *Geol. Soc. Amer. Bull.*, 44: 94, 1933; *Jour. Geol.*, 41, 52–66, 1933. F. A. Melton, *Discovery*, 15: 151–154, 1934; *Jour. Geol.*, 42: 97–104, 1934.

[3] C. Wythe Cooke, *Jour. Geol.*, 42: 88–96, 1934.

[4] Erwin Raisz, *Jour. Geol.*, 42: 839–848, 1934.

Jr.,[5] and the writer[6] have at different times expressed doubts as to the validity of the meteoritic hypothesis of origin. Cooke advanced the suggestion that the elliptical sand rims are in part wave-formed bars and beaches built in shallow lagoons during a higher stand of the sea, and in part crescent-shaped keys formed in shallow lakes. Prouty[7] and MacCarthy,[8] on the basis of magnetometer surveys, have supported the meteoritic hypothesis as advanced by Melton and Schriever, while Nininger[9] in his volume on "Our Stone-Pelted Planet" has apparently accepted the meteoritic hypothesis of bay origin as demonstrated. In the present brief communication it is not possible to analyze the arguments for and against the different interpretations advanced. This will be done somewhat fully in a small volume[10] now in preparation. But since the fuller discussion can not appear for some months, it seems desirable to set forth here certain results of recent observations in the "bay" country.

On the basis of field studies of bays in the Myrtle Beach area of South Carolina the writer in 1934 advanced the hypothesis that the bays represented former lake basins which had been rounded to the symmetrical oval form by wave action, while the rims were accumulations of windblown sand derived from the shores of the shallow lakes. A possible explanation for orientation of the ovals in a NW-SE direction was sought in the direction of the most violent winds, but without complete success. For while meteorological records demonstrated prevailingly greater intensities from the southeast in the southern part of the area, this was not true for the northern area. What wind conditions might have been during the glacial epoch remained problematical. No attempt was made to explain the origin of the lake basins, as sufficient evidence was not then available.

During the spring of 1936 the writer examined, in greater or less detail, more than one hundred of the bays scattered throughout seventeen counties in North Carolina, South Carolina and Georgia. In preparation for this examination he was greatly aided by the generous cooperation of Professor William F. Prouty, of the University of North Carolina, who placed at his disposal information and maps which greatly facilitated the study, and who accompanied the writer on a visit to some of the remarkable bays in Bladen County, North Carolina. The observations made in the three states seem to justify the following generalizations:

(1) The rims partially surrounding the oval depressions are not composed of the material constituting the coastal plain strata in which the depressions occur, as should be the case were they scooped up by meteoritic impact. They consist uniformly of clean, fairly coarse sand, identical in character with known windblown sand in these regions. Occasional sections show that beneath the sand rim the horizontal coastal plain beds remain undisturbed.

(2) The rims of sand are not heaped up symmetrically about the southeastern halves of the oval depressions, as might be expected were they ploughed up by meteoritic impact. Although exceptions occur, the locus of major sand accumulation is prevailingly along the southeastward portion of the northeastern sides of the oval bays and part way round the southeastern ends—in other words, prevailingly about the southeast quadrants of the bays. This fact was acutely observed and clearly stated by Glenn for the bays near Darlington, South Carolina, in his paper of forty years ago. But its significance was not then apprehended, and the fact itself has since escaped attention. Such distribution of the rims implies that a force (possibly dry winds following clear, drying weather) transported sand in one direction, whereas the force which formed the bays operated in a distinctly different direction.

(3) The oval bays are very frequently associated in a most intimate manner with numerous typical sinkholes of limited dimensions, steep sides and irregular form. Every conceivable transition can be traced from the small irregular sinks to the most symmetrical large bays.

(4) The larger and more symmetrical bays often occur where a thick deposit of sand or sandy loam covers a formation which elsewhere shows smaller and more irregular sinks. It seems inevitable that a small, irregular sink occurring in a soluble formation at some depth, must produce a larger, shallower and more symmetrical depression at the surface of an overlying bed of loose sand or sandy loam.

(5) The distribution of oval bays is found to correspond with the distribution of known beds of limestone, marl and coquina to such an extent as to create a strong presumption that there exists a genetic relationship between the two. In some places where bays occur in areas not known to be underlain by calcareous beds, layers of chert breccia or other deposits

[5] Fletcher Watson, Jr., *Popular Astronomy*, 44: 2–17, 1936.

[6] Douglas Johnson, Nat. Acad. Sci., Abstracts of Papers Presented at the Scientific Sessions, April 23 and 24, 1934, p. 30; also SCIENCE, n. s., 79: 461, 1934; Geol. Soc. Amer., Preliminary List of Titles and Abstracts of Papers to be Offered at the forty-eighth annual meeting, New York, N. Y., December 26–28, 1935, p. 16.

[7] W. F. Prouty, *Jour. Geol.*, 43: 200–207, 1935; Geol. Soc. Amer., Preliminary List of Titles and Abstracts of Papers to be offered at the forty-eighth annual meeting, New York, N. Y., December 26–28, 1935, p. 25.

[8] Gerald R. MacCarthy, Geol. Soc. Amer., Preliminary List of Titles and Abstracts of Papers to be offered at the forty-eighth annual meeting, New York, N. Y., December 26–28, 1935, p. 21.

[9] H. H. Nininger, "Our Stone-Pelted Planet," 237 pp., Boston, 1933. See frontispiece and its title.

[10] To be published by the Columbia University Press, New York City.

indicate the former presence of limestone or similar soluble formations. In other places the supposed absence of calcareous beds may well be due to the obvious insufficiency of available data; for marl deposits occur widely scattered as isolated patches under a concealing cover of Pleistocene sands, and the drilling of new wells from time to time reveals the presence of buried patches of marl the existence of which was formerly unsuspected.

(6) The orientation of the axes of oval bays is not nearly so uniform as has been supposed. The prevailing direction is northwest-southeast; but bays trending more or less nearly north-south are by no means rare, and examples trending northeast-southwest are known. The prevailing direction corresponds to the general trend of surface drainage when the coastal plain was raised above sea-level, and to the presumable direction of major groundwater flow, especially prior to extensive incision of surface valleys.

(7) The number of oval bays appears to be vastly greater than has generally been supposed. In the field one may count scores where the topographic maps show few. Aerial photographs which the United States Geological Survey kindly permitted the writer to examine show hundreds where the observer on the ground would be able to find only scores. They occur not by thousands, but certainly by tens of thousands if not by hundreds of thousands. Any acceptable theory of origin must account for the development of these forms in numbers which can fairly be characterized as "countless."

The facts summarized above, based for the most part on new observations covering a wide area, justify presentation of the following working hypothesis of bay origin: The depressions are due, directly or indirectly largely to solution of calcareous beds at varying depths below the surface, but possibly in smaller measure to the solution of alumina and iron in arkosic beds, after the manner described by Smith.[11] The fact that the soluble beds are usually buried by later formations accounts in part for the observed symmetry of form, as well as for failure of the sinkhole hypothesis to receive adequate recognition when the bays were first discovered. Lakes and ponds formerly occupied many of the sinks. Wave action perfected and to some extent altered the initial symmetry, and concentrated sand upon the shores. Winds then blew the beach sands upon the borders of the sinks, maximum accumulation occurring upon that part of the border toward which winds moved sand most effectively. This depended upon a number of variable factors, among which are the seasonal factor (when groundwater and lake levels are lowest and beaches best exposed), the cyclonic factor (when winds occur without rain and follow periods of clear, drying weather), as well as the variable strength of winds from different directions.

The terms "sink" and "sinkhole" have here been used in their broad, generic sense, to indicate surface depressions due directly or indirectly to differential removal of underlying soluble formations. It is fully recognized that in any karst region some solution cavities serve for the descent of surface waters underground, others for the return of such waters to the surface; and that the same openings may serve alternately first for one purpose and then for the other. Prouty has noted the fact that where lakes still occupy bays the water supply may come principally from "lake-bottom springs." That such supply may be copious is demonstrated by the large outflow from White Lake in Bladen County, North Carolina, cited by Prouty as an example of a bay filled with water coming chiefly from below. Others have found that waters entering sinkholes in one part of the coastal plain reappear at slightly lower levels in marshy bays, the outlet waters of which are relatively rich in calcium carbonate. In his field studies, and in his studies of topographic maps and aerial photographs, the writer has been impressed by the fact that great numbers of the oval bays, including many not at present occupied by lakes, have prominent outlet channels now draining, or formerly draining, into surface streams.

It is obvious that where uprising waters pass through loam they may remove the silt or clay, leaving the sand as residue. Wave action on lakes may similarly separate fine from coarse material. Where lake waters bearing clay or silt in suspension escape into surface streams, there may in time be a notable loss of solid matter. It has repeatedly been observed that far more material has been removed from the oval bays than can be found in the surrounding rims. It seems reasonable to suppose that this fact may often be due in greater measure to water transport from the basins, than to settling of surface sands into cavities formed in underlying soluble formations.

The foregoing is presented as a reasonable working hypothesis, not as a definitive solution of the puzzling bay problem. It seems to account for most characteristics of the bays more satisfactorily than any hypothesis previously advanced. Yet some phases of the hypothesis require further scrutiny. Whether solution of calcareous or other soluble beds by southeastward moving groundwater will explain the degree of parallelism observed in bay orientation or whether winds have influenced orientation remains to be determined. The fact that some bays occur in regions not yet known to be underlain by soluble rocks has already been noted. Account must be taken of the evidence produced by Prouty and his associates to show the

[11] Laurence L. Smith, *Jour. of Geol.*, 39: 641–652, 1931.

existence of magnetic highs (attributed to the presence of meteoritic bodies) near the southeastern ends of certain bays. These and other aspects of the problem will be fully discussed in the forthcoming account of the bays; and further evidence will be presented which seems to support the hypothesis that the bays are essentially the product, direct or indirect, of solution; and the encircling rims accumulations of wind-drifted sand.

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ALKALI DEFICIENCY AND FISH MORTALITY

IN the January 24 issue of SCIENCE, Dr. P. B. Sears suggests that the mortality of fish at Wallingford, Conn., reported by Mr. Tomlinson (SCIENCE, November 1, 1935), was primarily due to reduction in the quantity of "soluble alkaline minerals by the time the unsettled weather conditions . . . made their appearance." This interesting suggestion is unfortunately not confirmed by the chemical data obtained at the time of the mortality. When the reservoir was visited on August 2, 1935, the day following the mortality, the alkalinity of both surface and bottom water was found to be 57.9 p.p.m. as HCO_3. This value is comparable to that obtaining in a strongly eutrophic lake near North Branford, Conn., now under intensive investigation, and considerably higher than the alkalinity of other moderately eutrophic lakes in Connecticut. Moreover, the Wallingford locality had completely recovered its oxygen on September 28, 1935, when Mr. G. A. Riley and I revisited it, without any appreciable change in alkalinity (57.3 p.p.m.). It is therefore clear that a reduction in the alkali reserve played no part in producing the mortality.

A more extended discussion of the phenomenon will appear elsewhere.

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BACTERIOSIS OF PUMPKIN FRUITS IN CALIFORNIA

IN September, 1935, an outbreak of a soft rot of young pumpkin fruits (*Cucurbita pepo,* L. var. *condensa,* Bailey) was observed near San Pablo, Calif. The disease affected immature fruits of the varieties Early White Bush Scallop, Yellow (or Golden) Summer crookneck, Zucchine and Danish, being especially destructive on all but the latter variety. Counts showed a loss of from 60 to 75 per cent. of fruits in one field, with comparable losses in other plantings. Warm moist weather appears to favor this disease, which spreads rapidly through the agency of insects, particularly *Diabrotica sp.* Isolations made from infected fruits yielded a bacterium which upon repeated inoculations and reisolations has proved to be the causal agent. A similar organism was secured from two different localities in California and from pumpkin fruits grown at Corvallis, Oregon.

The disease affects only immature fruits. Infection of carrot roots and celery by the same organism also occurs under natural conditions.

The characteristic soft rot was produced in the following hosts: pumpkin fruits (22 horticultural varieties), carrot, celery, lettuce (leaves and stalk), cabbage (leaves and stalk), cucumber, turnip, onion, melon (four varieties), tomato fruits (green and ripe), cauliflower (leaves and stalk), stock, Opuntia (five species). The pathogen was identified as belonging to the genus Erwinia, since it possesses peritrichiate flagella. Though related in several ways it is not typical of *Erwinia carotovora* (L. R. Jones) Holland, from which it differs by having a different host range and distinct morphological and physiological characters.

Morphologically, the organism is a short rod measuring $1\,\mu - 1.2\,\mu \times 0.6\,\mu - 0.8\,\mu$. It is Gram negative and produces acid and gas in sucrose, but only acid in dextrose, glycerine, mannose, lactose, arabinose, invert sugar, salicin and amygdalin. The most striking difference from *E. carotovora* was observed on the eosin-methylene blue agar slants. On this medium *E. carotovora* produces a beautiful metallic luster comparable to that of *Escherichia coli* (Escherich) Castellani and Chalmers, while the pumpkin organism developed a light pink color in the growth without discoloring the medium. The pathogen could not be agglutinated in 2 per cent. NaCl solution at 96° C, while *E. carotovora* was agglutinated in 50 minutes. The optimum for growth is from 25° C to 31° C, while the upper thermal death point is 48.5° C.

A detailed study of the taxonomic position of the pathogen and of the susceptibility and resistance of pumpkin varieties is in progress.

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A NEW ESTROGENIC SUBSTANCE FROM OVARIES

IN the course of a series of studies carried out on the nature of unsaponifiable substance of various tissues, we have been able to isolate from ovaries a crystalline substance possessing a melting point of 95.1° C. (uncorrected), molecular weight of 320 (Rast) and of the following composition: C, 73.47 per cent.; H, 12.32 per cent.; N, 4.43 per cent.; O (by difference), 9.78 per cent.; which indicates a probable empirical formula—$C_{20}H_{41}O_2N$.

Biological assay on spayed rats indicates that .00001 milligram of the substance injected in a single dose