American Ethnology of the Smithsonian Institution, has returned from a six-weeks' archeological survey of Mexico, visiting sites previously mentioned in archeological literature, but only superficially explored, which may contain keys to the prehistoric development of new world culture.

DR. DERRILL M. DANIEL, entomologist of the State Agricultural Experiment Station at Geneva, N. Y., has returned from California, where he spent several months at the Citrus Experiment Station, Riverside, studying methods of the biological control of insect pests. On his return trip he spent some time in Florida, Georgia, South Carolina and Washington, D. C., visiting state and federal entomological laboratories.

THE first Edward Jasper Goodwin Memorial Lecture will be delivered by Dr. Robert Andrews Millikan, director of the Norman Bridge Laboratory of Physics and chairman of the Executive Council of the California Institute of Technology, in the chapel of the Packer Collegiate Institute on the evening of April 20. Dr. Goodwin was principal of the Packer Collegiate Institute from 1908 to 1918. Dr. Millikan will speak on "Science as a Social Force."

DR. GEORGE DAVID BIRKHOFF, Perkins professor of mathematics and dean of the Faculty of Arts and Sciences of Harvard University, president of the American Association for the Advancement of Science, will lecture on April 18 at 8:15 P. M. before the Lancaster Branch of the American Association for the Advancement of Science. His subject will be "Mathematics in the College Curriculum."

DR. F. C. KOCH, professor of biochemistry at the University of Chicago, will deliver the seventh Harvey Society lecture of the current series at the New York Academy of Medicine on April 21. He will speak on "The Chemistry and Biology of Male Sex Hormones."

DR. MARIUS B. GREENE, director of the Research Department of the Post-Graduate Association of Regional Anesthesia, formerly sanitary consul of the Allied and Associated Armies, delivered a demonstration lecture on March 29 on "New Surgical Methods of Treatment for Peripheral Paralysis and Allied Conditions" before the staff of the Army Medical School and Center at the Walter Reed Hospital, Washington, D. C. The session was presided over by Brigadier-General Raymond F. Metcalfe, and the discussion was opened by Lieutenant-Colonel Joseph F. Gallagher.

M. H. A. NEWMAN, of St. John's College, Cambridge, spoke at a meeting of the Galois Institute of Mathematics, which was held at the American Museum of Natural History on April 9. His subject was "Infinite Numbers."

DR. NIELS BOHR, professor of physics at the University of Copenhagen, spoke during an international broadcast from Copenhagen on April 5. His subject was "International Science." The program was arranged as a tribute to Dr. Bohr on the twenty-fifth anniversary of the announcement of his atomic theory. The program included a description of the recently erected research institute, which was dedicated on the same day.

THE fiftieth anniversary of the founding of the Rittenhouse Astronomical Society of Philadelphia was celebrated on April 8 with a dinner at the Robert Morris Hotel. Dr. John H. Pitman, of the Sproul Observatory, president of the society, introduced Dr. Jonathan T. Rorer, head of the department of mathematics of the Wm. Penn High School, as toastmaster, who reviewed the history of the society. After brief remarks by Dr. John A. Miller, director emeritus of the Sproul Observatory, and Dr. John E. Bryan, late superintendent of schools of Camden, N. J., Dr. Harlow Shapley, director of the Harvard College Observatory, spoke on "Fifty Years of American Astronomy." The Rittenhouse Astronomical Society was founded by the late Edmund E. Read, Jr., of Camden, and was chartered on April 1, 1888, as the Camden Astronomical Society. On October 12, 1927, the name was changed, to honor David Rittenhouse, pioneer American astronomer.

THE southeastern section of the Mathematical Association of America and the Georgia Academy of Science held meetings at the Georgia School of Technology, Atlanta, on April 1 and 2. More than 200 mathematicians from seven southern states and a hundred scientific men from Georgia were present. Fifty-three papers were presented. Dr. F. D. Murnaghan, of the Johns Hopkins University, was the visiting speaker of both organizations. He spoke on "The Basic Ideas of Arithmetic and Algebra" and on "Finite Deformations of an Elastic Solid."

DISCUSSION

PREHISTORIC QUARRIES AND IMPLEMENTS OF PRE-AMERINDIAN ASPECT IN NEW MEXICO

IN the course of geologic field work in New Mexico during the past summer two prehistoric quarries were visited and at one of them artifacts of unexpected type were found.

Fermor S. Church, master in Los Alamos School, and John T. Hack, a graduate student in geology at Harvard, were engaged in field work in San Pedro

Parks, a mountain top having a flat surface of low relief lying between 9,600 and 10,600 feet in altitude, at the north end of the Nacimiento uplift in Rio Arriba Co., N. M. I visited their camp on an inspection trip, from July 31 to August 3, 1937. Large areas of this flat summit area are underlain by a fine white to pearl-gray chalcedony, varying in thickness from 1 to 20 feet. The area of this unusual rock, about 40 square miles, and its relation to the relatively smooth surface, obviously part of a peneplain, is of considerable importance in the geomorphology and the Tertiary geology of the region. It will be fully described in a geological article by Church and Hack.

In one of the most northerly areas of this rock on the brink overlooking the canyons that lead down to the village of Gallina about 7 miles distant, there is an area of ancient pits in the chalcedony covering about 10 acres. These quarries lie in Sec. 22, T.22N, R.1E. The pits are 1 to 5 feet deep and 2 to 10 feet across. Some are filled with broken pieces of the stone, others almost empty. Except for a hammerstone of quartzitic sandstone, obviously a pebble brought up from the canyons to the north, there were no recognizable tools or pieces having a consistent shape. Nor was a workshop or camp located, but our reconnaissance was so short that traces of such features may have escaped our notice.

The discovery of this bed of chalcedony reminded me that Dr. H. T. U. Smith had found such a rock as a layer in Cerro Pedernal, a mountain 20 miles to the east. It is part of one of the Tertiary basin deposits of the Abiquiu Quadrangle[1] which is preserved in the highland area by reason of the lava cap of Cerro Pedernal. E. C. Cabot had previously described to me an ancient quarry in this chalcedony, obviously the work of primitives. Remembering this, I asked him to guide me there, and on August 13 we spent two hours at the site in the company of Mrs. Cabot, Frank Perkins, C. S. Denny and Charles Stearns.

This quarry consists of pits which extend along the outcrop of the chalcedony on the southwest side of Cerro Pedernal in Sec. 4, T.22N, R.4E. The site is a steep hillside reached by a trail from the road that runs up from El Rito Canyon, a distance of 4 miles from the little town of Youngsville. The pits are filled with broken pieces of the chalcedony, and a talus of broken quarried fragments extends down the hillside for more than 100 feet. At the eastern end of the ancient pits is a new hole obviously the work of a white man in which the bed is well exposed. It is 8 feet thick and rests on unconsolidated sand. The bottom 4 inches is black and banded and the top 6 inches is weathered to a porous crumbly and cream-colored layer. In this layer, colorless, pink and yellow chalcedony occurs in more or less isolated masses. The main body of the chalcedony is almost free from joints and is a pearly white to gray. Blocks 1 to 2 feet across, free from joints, can be easily obtained. This is an unusually good material for the making of stone implements.

The chalcedony of Cerro Pedernal has been known for a long time, and without much question the Indians resident in the area at the time of the Spanish Conquest knew of it, and hence the Spanish name of the peak, "Flint Mountain." The flint was used by the Pueblos as recorded by Hibben.[2]

At the site of the quarries there are piles and masses of small chips such as would result from making the small implements and arrow-heads of the Pueblo type. The greater part of the fragments are, however, of large size. We collected from the talus below the quarries and from the floors of the quarries 27 implements whose aspect is quite unlike any stone implement or artifact of the Pueblo Culture. Some of the implements resemble certain Paleolithic, Mesolithic and early Neolithic implements of Europe. That they have a comparable age is not necessarily implied by this similarity in form. They are but little weathered, although some are lichen-covered and all have somewhat duller edges and smoother faces than freshly broken material, as if they had suffered slight solution. The rate of weathering at this locality may be slow, although the site lies at an elevation of about 8,500 feet in the woodland zone with juniper and piñon. For this locality we have as yet no criteria for judging antiquity on patination and weathering.

The collection has been deposited in the Peabody Museum, Harvard University, where it has been given numbers 37–120–10/9576 to 9502. Mr. D. W. Lockard, fresh from study of the Paleolithic of France, has been kind enough to look over the collection and to give the attributions of Table I. He assumes no responsibility for the statements in the text not attributed to him. The similarity in the form of the implements to European types is not intended to imply any genetic relationship.

The forms in this collection consist of 2 fist axes of Abbevillian types and 3 implements of indeterminate type though of similar size and of somewhat similar form. These forms may, of course, be the remnants of blocks from which flakes have been broken off, but

[1] H. T. U. Smith, "Tertiary Geology of the Abiquiu Quadrangle, N. M," *Jour. Geol.* (in press).

[2] Frank C. Hibben, *Univ. New Mex. Bull.* (Anthrop. Ser.) 2: 1, 15, Pl. V[a], 1937.

TABLE I

IMPLEMENTS FROM PREHISTORIC QUARRY ON CERRO PEDERNAL, RIO ARRIBA CO., N. M.

Form	Length cm	Breadth cm	Thickness cm	
Abbevillian	14	6.5	3	
"	15	9	4–4.5	Especially good type.
Levallois flakes.	11	7	1.5 at thick end.	
	12	6.5		
Axe (a)	15	7.5	4.5	
"	14	6	4	Roughly rectangular cross-section; one shows much use and has been rechipped at later date.
"	13	6	4	
"	13	6	4	
"	13	6.5	4	
Axe with twist (b)	13	4.5	3	One end has offset and 30° twist in lateral axis.
	13	5	2.8	
Broken axe ...	9	6	4	Axe (a) type.
" " ...	9.5	6	3.5	Axe (b) type.
" " ...	9	6.5	3.5	Cross-section is lozenge-shaped; not quite (a) type.
" " ...	10.5	7	2.5	
" " ...	10	8	4.5	
" " ...	11	7.5	4.5	
" " ...	14	9	4	Shape rectangular; cross-section is lozenge-shaped; small break.
" " ...	6	10	3.5	Small piece of above type.
Points	12.5	6.5	2	More or less pointed.
"	13.5	6	1.7	Oval base and point at other end.
Axe (?)	15.5	6	3.5	Flat face on one side; crest on other.
Triangular scraper (?) .	9.5	9×10	4	Worked on both faces from all sides.
Hammer stone .	8	7	5	Basalt.

that two of them have a strict conformity to type, on Mr. Lockard's testimony, leads me to believe that they all are designed for use.

Two specimens, on Mr. Lockard's identification, are typical Levallois flakes with the characteristic faceted striking platform.

The foregoing are the types having a definitely Paleolithic aspect. Two or more of each type are present, and the range in size is small.

The remaining implements are mostly axes or picks. Of these, type (a) is represented by 5 specimens that are remarkably regular in size. Each is roughly rectangular in cross-section. One of them has a squarish end and has been much used as a maul. It also has been rechipped at a later date as shown by differences in patination between the older and newer surfaces. Mr. Lockard points out that these implements have a strong resemblance to Early Neolithic axes.

There are two axes of type (b). These forms may be variants of type (a), but the section is more lozenge-shaped. Each is offset slightly near one end, where the lateral axis is rotated 30° from that of the main part. This twist is very characteristic. If one should imagine that these implements were hafted by thrusting into a bone, their peculiar "twist" would be advantageous. Mr. Lockard notes that these implements have a general resemblance to Late Mesolithic and Early Neolithic picks (Campignian and Ertbölle).

Eight implements are listed as broken axes. Of these, one is of (a) type and one of (b) type. The others are larger and more generalized, with lozenge-shaped cross-section. They have, according to Mr. Lockard, a pseudo-Acheulean aspect, and the right angle breaks might be interpreted as the beginning of a preparation for striking off a Levallois flake. However, there is no evidence of the faceting characteristic of a Levallois striking platform. It seems more likely that they are the broken parts of crude chipped axes or hammers which lack the rectangular section and conformity in size of type (a).

The points are less distinctive than the other implements. They would fit into a collection from almost any hunting culture. They are, however, not Puebloan.

The remaining implements can not be interpreted, but the large size of the axe (?) and scraper (?) make them unlikely components of the Pueblo stone culture.

At the time of collection the first hypothesis that came to mind was that these were blanks roughed out at the quarry for transport to a more convenient locality for the manufacture of a final product. The data assembled show that there are several forms which are like implements of the early stone cultures of Europe. Why should the forms of blanks imitate implements of earlier cultures? Is it possible that these quarries were opened by pre-Amerindian peoples? The rejects and implements of these earlier quarrymen may have since furnished material for making the smaller tools of the later tribes. Such a hypothesis needs testing by excavation of the site, which would reveal many new facts and perhaps lead to an entirely new hypothesis. However, it should be realized that if the forms were produced by pre-Amerindians, it does not follow that they were contemporaneous with people who made similar tools in Europe. Nor is it necessary to conclude that successive waves of Abbevillian, Levallois and Mesolithic peoples inhabited the region. All that these finds seem to imply, in the present state of our knowledge, is that peoples of unknown character but having a different and apparently non-Pueblo stone culture, have lived in the area. Much recently acquired information leads to this same generalization and the Folsom[3] and cultures of similar age are well established. The fine chipping of these cultures is not here repeated. However, in the collection from Lake Mojave[4] there are large core and flake implements which are in many

[3] F. H. M. Roberts, *Smithson. Misc. Coll.*, 94: 4, 35 pp., 1935; *Idem.*, 95: 10, 38 pp., 1936. A. E. Jenks, *Amer. Anthrop. Assoc. Memoirs*, No. 49, 49 pp., 1937.

[4] E. W. and W. H. Campbell and others, *Southwest Museum Papers*, No. 11, 118 pp., 1937. See C. A. Amsden, Pl. xxviii, b, and c, pls. xxx, b, and xxi b.

respects comparable in size and type of workmanship to some of the forms of this collection. Many of the Lake Mojave implements, as is evident from the published plates, have been much modified by the cutting of wind-driven sand and their original form obscured. It would be premature to attempt a correlation by typology. Nevertheless, the existence of the Lake Majove types lends support to the hypothesis that the finds at Cerro Pedernal, are not blanks, but the implements of a hitherto unrecognized culture or cultures.

KIRK BRYAN

CAMBRIDGE, MASS.

VEGETATION ON SHELL MOUNDS, LOWER CALIFORNIA

THE interesting note by Hrdlička[1] on the distinctive plant life of native village sites in Alaska brings to mind parallel phenomena observed by the writer two thousand miles farther south on the Pacific coast.

The marine terraces which skirt the northwest coast of Lower California are dotted with shallow but extensive Indian shell middens. Near Pabellon Canyon (southeast of San Quintín), where the marine terrace zone is eleven miles wide and rises by gentle steps from sea level to 1,600 feet above sea level, a field survey was made across the entire terrace zone. Shell mounds were largest near the coast, but even along the six miles at the landward end of the survey line twenty shell middens were observed. On the average, each of these inland middens covers about an acre and is a foot and a half deep at the center. The deposits consist principally of ashes, broken clamshells and blackened rock chips.

The middens are covered with dense brush, of *Franseria chenopodiifolia* interspersed with California sagebrush. The surrounding terrace surface is either gravelly, with an open formation of agave and cactus, or a crumbly clay sparsely covered with low annuals, especially tarweed (*Hemizonia lobii*). The compactness, height and color of the *Franseria* thickets made it possible to discover middens from a considerable distance. In July, the dirty yellow-green of the thickets stood out in marked contrast to the grey-brown of the higher agave and the buff-yellow of the lower tarweed formations.

Accidental transportation of seed by Indians and favorable soil in the middens explain the dominance of *Franseria*. A small tenacious burr favors dissemination. Coastward, the plant grows abundantly on the silty lower terraces below a level of 800 feet, and Indians must have involuntarily accumulated many burrs as they returned inland from digging clams along the coast. *Franseria* also abounds on the silt floors of the deep canyons which traverse the terraces, and some burrs may have been picked up when the Indians brought water from the arroyos to their camps on the dry ridges along which ran their trails to the interior. Since the plant had no known economic value to the Indians, deliberate transportation is ruled out as a possibility. Once brought to the middens, the seeds thrive on the rich ashy soil, but do not grow on the surrounding gravel and clay.

Seaward from the 800-foot level, midden vegetation is distinguished by the fog-loving ice plant, *Mesembryanthemum crystallinum*. This plant flourishes not only on shell mounds but wherever else the soil has been recently disturbed: on abandoned roads and fields, disintegrating adobe mission walls, rodent diggings and recently eroded surfaces.

Twenty miles farther south, another detailed survey revealed similar relations between middens and vegetation on the ridges and canyons of the eroded marine terrace.

Expert comparative study of midden vegetation might throw light on such subjects as Indian routes and (through analysis of plant successions) the relative recency of abandonment of *ranchería* sites.

PEVERIL MEIGS, 3RD

STATE COLLEGE,
CHICO, CALIF.

THE LEVEL OF THE OCEAN DURING PART OF THE CENOZOIC ERA

THREE problems of the Cenozoic Era are: (A) Submarine channels on the continental shelf; (B) severe changes in climate, including a period of continental glaciation, and (C) intercontinental migration of land animals.

The submarine channels on the ocean side of the continental shelf of North America, both on the Atlantic and the Pacific side, show from the recent surveys extended consequent courses with deep narrow valleys of the canyon type. They have tributaries with branching angles of less than ninety degrees. The evidence is that they were formed by corrasion of running water.

A great lowering of the ocean level would give gravitational impulse to river water to accomplish this sculpturing.

Following the theory of the origin of nebulae by tidal disruption on the approach and close passing of two heavenly bodies, it is plausible to think of a minor heavenly body so passing the earth. This passing might well abstract surface water from the globe, including a large fraction of the volume of the oceans. Instead of a single approach there may have been a series.

The water so withdrawn would be lifted into the stratosphere and assume a configuration like the

[1] Aleš Hrdlička, SCIENCE, 86: 559–560, 1937.