periment with excess added electrolyte in the case of viscosity and leads to the same conclusions concerning association.

Conclusion

The purpose of this presentation has been to summarize some recent work on the physical chemistry of synthetic polyelectrolytes. In three fields—hydrodynamics, electrodynamics, and thermodynamics—we have seen that the properties of these compounds could be described, at least qualitatively, in terms of the chain model of neutral macromolecules combined with the effects of electrostatic forces. Similarities between the behavior of proteins and polysaccharides and that of the synthetic polyelectrolytes suggest that a better understanding of the biological materials may be attained through a study of the synthetics, thanks to the controllable variability which the latter offer to the experimenter.

University of California African Expedition—Southern Section

Charles L. Camp

THE UNIVERSITY OF CALIFORNIA at Berkeley, through the Museum of Paleontology, has, during the past 15 months, sponsored a program of scientific work in southern Africa. The primary purpose has been to search for further fossil evidence of the anatomical form, habits, environment, and geological age of the remarkable australopithecine man-apes first described by Prof. Raymond Dart and elaborated by Dr. Robert Broom.

Another important objective was a coordinated series of anthropological studies on the primitive tribes of northern South-West Africa, where conditions have been favorable for the preservation of ancient customs and tribal life. Attention was directed to ethnology, linguistics, physical and cultural anthropology, psychology, ethnobotany, ethnozoology, and musicology among the Ovambo. Some work was also done among the Kung Bushmen and the few surviving Hottentots who retain traces of their original culture.

A program having to do with recent and fossil plants has been carried out successfully. Extensive collecting of recent amphibians, reptiles, mammals, and insects, including protozoan parasites of termites and studies in ethnoentomology, are being conducted by two members still in the field.

Work began in August 1947 with a survey of Cretaceous localities near Port Elizabeth. Early in September the two paleontologists, Frank Peabody and the writer, accompanied a geological excursion arranged by Dean George B. Barbour, of the University of Cincinnati. Quaternary cave and travertine sites were visited from the Makapaans valley and Thaba Zimbi, 200 miles north of Pretoria, south to Taungs, 100 miles north of Kimberley. Members of the party included Profs. Alexander du Toit, Raymond Dart, C. J. VanderHorst, C. van Riet Lowe, and Dr. S. H. Haughton, the head of the Geological Survey.

Under their counsel it was decided to commence operations at the works of the Northern Lime Company, near Taungs, and as close as possible to the old type-site of *Australopithecus*. During the next 6 months some 30 sites were investigated in the vicinity, along the eastern edge of the Kaap Plateau from Boetsap to the quarries north of Norlim.

The earliest breccias—gray, water-washed, gravel conglomerates at the base of the Norlim lime biscuit —contain antelope and horse remains and no crushed baboon skulls such as are found in the supervening pink sandstone breccias in the *Australopithecus* zone. Above the pink breccias the travertine spring deposits are honeycombed with later, filled caves and vertical pipes containing dark brown earths and secondary lime. Many of these contain late Pleistocene artifacts and ash deposits. Still younger caves, along the outer margins of the lime bodies, remain as open cavities in which may be found brown and yellow earth, dust, ash, and bat and hyrax guano. Artifacts of pre-Bushman and Bushman types occur in these more recent deposits.

Middle Stone Age artifacts sealed in place in solidified cave floors occur with human teeth and mammal bones, south of Norlim, and the same type of artifacts were found in yellow sandy travertine at Mooiplats, 60 miles north of Zeerust.

It is therefore believed that a number of sequential stages of Quaternary history will become recognizable when the faunas and artifacts are studied. None of the man-ape sites contains evidence of fire or artifacts. They must antedate the abundant caves in which artifacts occur.

After a month in the Mesozoic of South-West Africa and a tour of 6 weeks in the reptile beds of the Karroo, work was begun at Gladysvale, where samples were taken from the immense bone deposits in a stratified sequence of cave fills.

During the period April–July 1948, excavations were conducted at Bolt Farm, near Sterkfontein caves, and at adjoining farms and lime pits. Material was secured from 26 pits which apparently vary in age as they do in fossil content. The pink breccias in this area contain rare remains of man-apes as well as a host of mammals. The abundant rodent and insectivore remains (owl breccias) may serve to indicate climatic conditions. An elephant tooth should aid in dating. Australopithecine femora associated with baboon skulls were found in the pink breccias in two pits. The baboons, ranging from small, short-snouted species to some with jaws larger than those of a man, should be valuable as horizon markers.

A small sabre-cat, represented by three skulls and associated skeletal parts, seems to have been responsible for the litter in one cave; another may have been a jackal lair; and still others contained hyena, baboon, small monkey, pig, and a large series of antelope, carnivore, and horse bones and teeth.

Reptilian and amphibian material from the Karroo was secured mainly in the upper zones of the Beaufort and the Stormberg. Skeletons of late mammal-like forms, *Cynognathus, Trirachodon,* and others, were obtained near Rouxville. An average of four good specimens were taken each day during the 6-week period, indicating the great wealth of fossils constantly coming to light as these soft beds are eroded away. The Bernard Price Foundation has given the University a fine lot of additional Karroo material in exchange for the use of a truck.

There is no other known area where such an abundant and varied reptilian fauna occurs. The earliest known ancestry of the mammals, the crocodiles, the lizards, and the turtles is represented in these beds, which also provide a good view of the history of many extinct reptilian families.

The vertebrate history represented in South Africa fills two main gaps in the North American record—the late Permian and Middle Triassic, and the early history of man.

It was with these thoughts in mind that the paleontological program was organized, and it was carried out with generous assistance from the Geological Society of America, the American Philosophical Society, and the National Academy of Sciences.

The geological work was done by Profs. Barbour and Peabody and the writer, and a report on the Taungs area is now being completed. New evidence concerning distribution of Mesozoic beds and faunas in South-West Africa is being incorporated into the latest edition of du Toit's *Geology of South Africa.*

Through the courtesy of Prof. C. Van Riet Lowe, head of the Archaeological Survey and the Department of Archaeology, Witwatersrand University, a member of his staff, Dr. B. M. Malan, accompanied and guided two members of the expedition on a three-week exploration of Wonderwerk Cave, near Kuruman. A sequence of levels in this large cave produced evidence of cultures as far back as early Stone Age, accompanied by faunas.

Artifacts collected by the Expedition are now being studied by Dr. Malan, and duplicate series will be sent to us after the papers are written.

The anthropological survey in all its branches was conducted by the ethnologist, Dr. Edwin M. Loeb. On the first long trek into Ovamboland his party consisted of Dr. and Mrs. Loeb, the artist and photographer; Boris Iflund, the psychologist; the two musicologists, Mrs. Laura Boulton and Charles M. Camp; and Mr. Eric W. Williams, the technician from Prof. Dart's laboratory of physical anthropology at Witwatersrand University in Johannesburg.

A second expedition to South-West Africa by the Loeb party was made in the spring of 1948 and was accompanied by Dr. L. H. Wells, the physical anthropologist from Prof. Dart's staff, and by Dr. Carl Koch, the entomologist.

Ethnological work was chiefly concentrated on the Kuanyama Ovambo. Preliminary data have been published by Dr. Loeb in *African studies* (Witwatersrand University, March and September 1948). He states:

> The Kuanyama are a dual culture resulting from the admixture of cattle-raising Hamites from the north with the agricultural (hoe culture) negroes of Africa. These two layers were probably superimposed on a primitive hunting and fishing culture similar to the Bushman. A study of the isolated primitive Kuanyama culture will give a new appraisal of the resulting contacts between hoe-agriculture and early cattle-raising peoples, not only as elsewhere in Africa, but in the Mediterranean World, as well. For example, the agricultural peoples in the areas tend to be matrilineal, whereas the cattle-raising peoples are uniformly a patrilineal social organization. These agricultural peoples have developed the plastic arts, but the politically minded cattle-raisers have neglected the plastic arts and have tended to dominate the more passive agricultural peoples, suppressing the women and children in their social relations. The correlation of ethnological traits with the psychological studies of the individual personality will show the overt and introvert adjustments of age and sex groups to the complexities of a dual agriculture and cattle-raising organization.

Data were secured on a wide range of ethnological, linguistic, psychological, and physical problems. Measurement indices seem to indicate the presence of Hamitic trends in the Kuanyama and of Mongoloid in the Bushman.

Plastic facial and bodily masks and casts, physical measurements, photographs, cinematographs, Kodachrome and Ectachrome slides and transparencies, and drawings and paintings were obtained. Extensive grammatical notes, word lists, translations of texts, and phonetic data were made. Cultural objects collected include articles of dress, utensils, and weapons.

The botanical work, independently carried on by Mr. Robert J. Rodin, of the University Herbarium, resulted in the collection and identification of 35,000 pressed plants, 500 live plants, mostly succulents, as well as seeds, bulbs, seaweeds, fossil leaves, and wood from the petrified forest discovered in the Kaokoveld by the Expedition. Forage grasses from the Kalahari were obtained for the agricultural experiment stations and may prove to be serviceable on the arid ranges of the southwestern United States. Ethnic and medicinal plant uses were recorded in the native territories, and seasonal plant food charts were obtained as a contribution to ethnobotany. Cooperation was secured from the members of Dr. Loeb's party, with whom Mr. Rodin stayed for a time, and from the botanists, botanical gardens, and herbaria of South Africa and Kew Gardens in England. Dr. Koch and Mrs. Loeb also added to the plant collections. Interesting studies and color photographs were made of the peculiar xerophytic floras of the Namib Desert, especially of the curious relict gymnosperm, *Welwitschia* (*Tumboa*).

Mr. Rodin collected in the mountains of southern Rhodesia as well as throughout South and South-West Africa.

Mr. Thomas J. Larson, the mammalogist, obtained 1,000 study skins of recent mammals as well as skulls and skeletons for comparison with fossils from the Quaternary caves. Among the mammals are a good series of recent baboon skulls, lion skulls in several growth stages, a skeleton of the rare insectivorous hyaenid, *Proteles*, series of golden moles, elephant shrews, embryological and complete material in alcohol for anatomical study. Special attention was paid to rodents, antelopes, and other forms commonly found in the fossil deposits. Several hundred specimens of amphibians and reptiles were collected by Mr. Larson and other members of the Expedition.

The entomologist, Mr. Carl Koch, arrived from Austria in April 1948 and joined the second Loeb party into Ovamboland. In that short time he collected some 30,000 insects, especially tenebrionid beetles, and also protozoan parasites of termites from regions where such material has not previously been collected. He and Mrs. Loeb have listed the uses of over 30 animals, and he has also determined some interesting uses of insects in native food, magic, and poisons. His continued work this fall will carry him again across the Kalahari and into Ovamboland, Portuguese Angola, and the Kaokoveld.

Native songs and instrumental music permeate the life of the tribes, as long as tribal life is allowed to continue. With the decay of the tribal communities and the incursion of white influences, this stimulating and unique phase of the South African scene will disappear. Native music has developed into rhythmic forms which are more complex and interesting than those in other parts of the world. The accuracy and effectiveness of these patterns of interlocking rhythm carry African music into a sphere of its own.

The Expedition devoted attention to recording and translating songs, chants, dances, and instrumental and orchestral material. A panel van was fitted up with a large Presto recorder run by batteries, and records were made among many native groups throughout South Africa, South-West Africa, northern and southern Rhodesia and central Angola.

Mrs. Laura Boulton was with the party during the first half of the year; during the second part Mr. Hugh Tracey and his newly established African Musical Research Institute gave exceptional aid to Mr. Charles M. Camp, of our group. The nearly 1,000 recordings which were secured will be available to students at Berkeley and Los Angeles. Mr. Tracey has also agreed to send further recordings and translations made by his laboratory to the University and to provide means for students from the University to study in the field. In return for this, Mr. Tracey has been supplied with copies of records made by Mr. Camp this spring, as well as the use of transportation facilities.

The Expedition is deeply grateful to the General Motors Corporation, the Shell Oil Company, the Presto Company of New York, the Farrell Steamship Lines, Ingersoll-Rand Ltd., of Johannesburg, The Union Defense forces of South Africa, the University of Witwatersrand, and many other individuals, officials, and institutions for generous aid.