about thirty miles west of the Sierra Nevada foothills. Conditions at the site strongly suggest that the carcasses of the now extinct mammals were brought there by hunters of the group which built fires, buried its dead and made the numerous stone and bone artifacts which have been found in the deposit. The bones of the American camel, horse and bison occur along with bones of species still living in the San Joaquin Valley, broken in a manner characteristic of kitchen refuse, along with artifacts and in the vicinity of burials.

All bone on the site, whether human (four individuals were still wholly or partly articulated in a semi-flexed position), of animals, both extinct and modern, or of the numerous bone awls and other implements, is very heavily mineralized, with about twice the specific weight of ordinary dry bone and with greatly increased hardness. Out of more than 100 San Joaquin Valley archeological sites investigated by W. Massey, G. Schmidt and the writer in 1939, the Tranquillity site was the only one on which such mineralized bone occurred.[2] It was the condition of the bone which prompted further work, rather than the identification of the extinct species, which was not completed until this year (1942).

Faunal remains include two extinct species: *Camelops sp.*—mandibles, teeth, astragalus; *Equus sp.* (presumably the extinct American horse)—several teeth *Bison sp.* (not necessarily an extinct species, but unknown in the local fauna in historical times) is represented only by a tooth and orbital fragment. In addition, there was much unidentifiable fragmentary long-bone material on the site which seemed too large for any but the foregoing animals. Other forms are still surviving species: pocket gopher, badger, coyote, fox, jackrabbit, dwarf elk, antelope and salmon.[3]

Artifacts include a wide range of chert and obsidian point types, scrapers, blades and a drill; metate, mano (the latter very abundant); pestles, and mortar fragments (few); side-notched net-sinkers; grooved end stone (a possible "Charmstone"); two steatite sherds; asphaltum lumps; much burnt clay, some with stick, reed and mat impressions; bone awls, points and spatulate objects, all heavily mineralized; 56 obliquely lopped-end *Olivella* shell beads, associated with the burials, and a miscellany of broken stones of various kinds, none obtainable from the immediate neighborhood. The artifacts, while generically "Californian," are not like those of any recent archeological culture from the Central San Joaquin area, though they are similar to those from certain "early" cultural complexes described from elsewhere in the state.

In the light of finds from other parts of the continent, the occurrence of the extinct *Camelops* along with horse and bison in an archeological site is not surprising.[4] What makes the site especially interesting are the human burials, which seem to belong to the same horizon as the artifacts and extinct animals. If further work on the Tranquillity site were to establish the contemporaneity of the skeletal materials beyond question, we could determine the physical type of an early Indian population in North America for which there has been so far a great paucity of skeletal data. The writer hopes that a more detailed description of the site and its materials may be published, as there is little likelihood of further work on the site until after the war.

GORDON W. HEWES

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[1] The collections from the Tranquillity site are now in the University of California Museum of Anthropology, Berkeley.

[2] Gordon W. Hewes, *American Antiquity*, 7: 123–33, 1941.

[3] Faunal remains secured in the early work on the site were identified by Dr. Chester Stock, California Institute of Technology, Pasadena, as elk, bison, gopher, *Canis* sp., and camelid. Dr. Stock hesitated to identify generically on the basis of a single Camelid astragalus. Later and fuller collections, including mandible material, enabled Drs. Stirton, Vanderhoof, Camp and Wells, Department of Paleontology, University of California, to identify the camelid as *Camelops* sp. The later collection also included *Equus* teeth and badger bones, not present in the material sent to Dr. Stock.

[4] See the papers by F. H. H. Roberts, Jr., and Julian Steward in "Essays in Historical Anthropology of North America," *Smithsonian Institution, Miscellaneous Collections*, vol. 100, 1940.

PURE NATURAL NITROGEN GAS[1]

REFERENCE by Science Service on January 1, 1943, to an earlier account of the finding of pure nitrogen gas in a well as one of the notable discoveries of the year is misleading and the subject is perhaps worthy of brief comment. In SCIENCE of February 27, 1942, Mr. Harold J. Cook reports that 100 per cent. pure nitrogen gas was found at a depth of only 156 feet in a well drilled on the W. H. Cross ranch near the southern rim of the Powder River Basin, Wyoming. The gas is said to have developed a rock pressure of 11 pounds in 10 minutes and it is suggested that because of its purity the gas may have value in the present war emergency.

High-percentage natural nitrogen gas wells have been known for many years and are particularly common in the Permian Basin of Texas and New Mexico. Here nitrogen gas may be confined under pressures as high as 1,500 to 2,000 pounds per square inch. Analyses of some of these gases show them to contain

[1] Published by permission of the Director, Geological Survey, U. S. Department of the Interior.

from 97 to 99 per cent. of nitrogen. When a 7- or 8-inch drill penetrates a high-pressure gas pocket the gas issues with a roar that can be heard a mile or more away and the well may continue to blow for a period lasting from a day to two weeks before the pressure is sufficiently reduced to permit resumption of drilling. The initial gas flow of large wells may reach 50,000,000 cubic feet per day from a reservoir having a possible total storage capacity of one half to one billion cubic feet of nitrogen gas. Most of these nitrogen gas pockets, however, are small and many are exhausted by open flow in a day or two.

The writer has observed that large accumulations of nitrogen gas may be confined in rocks which are related to basins of saline or brackish-water deposition. The rock minerals more commonly associated with nitrogen gas in the Permian Basin are halite, anhydrite and dolomite. Pockets of nitrogen gas are most common in the Salado formation of the Permian Basin. Though they are encountered less often in drilling through the Chalk Bluff formation, which underlies the Salado, the reservoirs are usually larger and their gas pressures higher because of their lower stratigraphic position and greater depth. In the Amarillo area nitrogen gas occurs still lower in the Permian section.

Nitrogen gas accumulations indigenous to sedimentary rocks are likely to be due either to a generation of the gas by chemical reactions occurring within the sediments or by the abstraction of oxygen from air entrapped with the sediments during deposition. The question of origin of the gas involves more discussion than can be offered here. Some oxygen is reported in most of the analyses of high nitrogen gases, which suggests that the nitrogen gas of the Permian Basin may be air from which most of the oxygen has been removed.

The critical evidence to support this hypothesis is not now available. Unfortunately, the routine cryogenic analysis does not determine and report the presence of argon or the other inert gases krypton, xenon and neon. Helium is reported for special investigations only. If any of these inert gases is present it appears in the report as nitrogen. Thus no natural nitrogen gas can be considered pure unless assurance is given that no appreciable quantities of the other inert gases are present with the nitrogen. Air contains about 1 per cent. of argon and if oxygen is removed argon will make about 1¼ per cent. of the remaining gases. If the gases of the Permian Basin that contain 98 per cent. of nitrogen are found upon analysis to have about 1 per cent. of argon, the evidence will be fairly conclusive that these gases were derived from the atmosphere.

Nitrogen gas formerly considered worthless is becoming useful in industry. The atmosphere, which is about 75 per cent. nitrogen, provides a universal, inexhaustible supply of this gas for the manufacture of acids and fertilizers. Nitrogen is now employed with argon in making electric lamps. Both gases are refined separately and then used for a specific purpose in lamp manufacture. Nitrogen from gas wells could be used as a substitute for carbon dioxide to smother enclosed fires which do not require a heavy gas, for quenching fires in the fuselages and motor nacelles of airplanes and for inflating rubber boats.

WALTER B. LANG

U. S. GEOLOGICAL SURVEY

FRANZ BOAS, PSYCHOLOGIST

IN their appreciations of Franz Boas, Benedict[1] and Lowie[2,3] have discussed his professional career, beginning with his early training in physics, geography and mathematics and culminating in his pioneer contributions to physical and cultural anthropology, linguistics and ethnology. Proper emphasis, however, has not been given to the fact that toward the end of his career, Boas became increasingly interested in *psychological* problems. In fact his chief interest seems to have shifted from the anthropological description and intercomparison of cultures *per se* to the psychological description of the specific stimulating conditions under which the individual's responses are acquired. The various investigations of motor behavior carried out by his research associates, covering such studies as those on posture, walking, speed of tapping and gesture, serve to illustrate this interest in experimental social psychology. That Boas maintained an interest in this field to the end is attested by his last letter to the writer, written four weeks before his death, in which he discussed certain methodological considerations in connection with a proposed study of bodily movements accompanying speech in the American Negro.

As more and more data were accumulated, Boas became increasingly certain of his position in explaining the individual's behavior in terms of his previous stimulation and resulting reactional biography rather than in terms of such typological constructs as "race." It is in this area of the social conditioning of behavior that one appreciates Boas's interest in psychological theory, and certainly here one must disagree with Lowie[2] and find Boas more than "a faithful, intelligent collector of raw detail." Experimental social psychology has lost one of its ablest students in his death.

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[1] R. Benedict, SCIENCE, 97: 2507, 60–62, 1943.
[2] R. H. Lowie, *Scientific Monthly*, February, 1943, pp. 183–184.
[3] R. H. Lowie, SCIENCE, 97: 2513, 202–203, 1943.