## 36. AN OBSIDIAN IMPLEMENT FROM PLEISTOCENE DEPOSITS IN NEVADA[1]

By W J McGee[2]

Walker river has the form of a compressed horseshoe. It gathers among the foothills of the Sierra Nevada mountains in Eastern California, between the fair Lake Tahoe -- the gem of the Sierras -- and the foul Lake Mono, and, quickly embouching from the narrow canons of its birth into the broad valley of its principal course, passes into Nevada between the Sierras and the Wassuck mountains (or Walker River range). Thence for 50 miles northward it meanders through the flat-bottomed Walker valley in a shallow willow-fringed channel. Opposite the north end of the Wassuck mountains its course swerves to the eastward and then to the southward through a contracted valley or outer cañon sweeping around the end of the range; and the southerly course is maintained 20 miles before the river falls into the lake of the same name in which its waters extend yet another 20 miles southward. At the toe of the horseshoe, around the northern extremity of the enclosed mountain range, the previously shallow channel deepens,and the river flows through a steep-walled inner canon, reaching 300 feet in depth; and in the canon walls the deposits of the valley are exposed in a superb series of stratified beds from which the Pleistocene history of the region may be easily read.

The valley of Walker river, from a few miles below the embouchure of its mountain-bound cañons to and beyond the extremity of the lake in which its waters are evaporated, forms a part of the basin of the extinct Lake Lahontan, which has been restored and immortalized by King and Russell; and the history recorded in these deposits coincides with that read from the mechanical sediments, the chemic precipitates, and the ancient shore lines of other parts of the same old lake and of other extinct lakes in the same quarter of the country. This history comprises three principal episodes: First, an episode of cold and wet, during which glaciers formed within the mountains, and outletless lakes formed or expanded in the valleys; second, an episode of warm and dry climate, during which the glaciers melted, the lakes were evaporated to or below their present level, and cañons were cut in the newly formed sediments; third, a shorter episode of cold and wet, during which glaciers again formed in the mountains, and lakes in the valleys, and another sheet of sediments was laid down; and then came the present period of dry and warm climate, during which the glaciers were obliterated and the lakes evaporated, and the sediments, new and old alike, were laid open by the rivers in their descent toward the lowest points in the mountain-bound basins.

Some of the details of the general history are obscure, but they are elucidated in a measure by the present condition of the region. In the present episode of warm and dry climate, the Lake Lahontan area is

a sun-scorched semi-desert, with scant foliage on the mountains, with the meagre and sickly verdure of desert plains (save where reclaimed by irrigation) in the valleys, with rare springs on the slopes, and with shrunken lakes of bitter water in the lowest depressions; the fauna is still poorer in species and generally in individuals than the poor flora; and the human population found by the white pioneers -- the "Diggers" of the early overland pilgrims -- was perhaps the most wretched and degraded of the land. The present conditions of aridity in climate and poverty in life must reflect and repeat the like conditions of the inter-lacustral period. With the second chilling of climate and checking of evaporation, the rivers and lakes expanded, a richer and more varied fauna immigrated or developed, and the elephant and rhinoceros, the camel and horse, the ox and the deer left their bones by thousands in the marshes about the shores of the sweetened lakes; moreover, to support a fauna so rich and varied, an equally rich and varied flora must have covered the upper valleys and clothed the lower mountains. And this wealth of life manifestly reflected and repeated the like condition during the first episode of cold and wet. So the Walker river deposits and their correlatives, and the present condition of the region, together record two epochs of meagre life, one of which is past while the other persists, and two epochs of abundant life, both long past; and the latter have been demonstrated by physical geologists to correspond with the two great ice invasions of the northeast.

On October 6th, 1882, I rode along the low scarps and higher salients of white marl forming the walls of the inner cañon of Walker river, some 15 miles above the head of the lake, searching for fossils; and here and there I found within the marls a bleached and porous bone, or within the associated brown sands an iron-stained and heavy tooth or bone of horse, ox, elephant, or camel -- the abundance being such that a day's collection gave as much material as could be conveniently carried behind the saddle. The cañon walls there exhibit the following succession:

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| 1. | Stratified loam, sand, and white silt, without fossils, | 5' to 25' |
| 2. | A discontinuous layer of calcareous tufa . . . . . | 1/4" 2 1/2 |
| 3. | Massive, finely laminated, or obscurely stratified fine silt or marl, generally snow-white, with fossil bones about its base. . . . . | 20 " 50 |
| 4. | Somewhat ferruginous and pebbly stratified sand containing numerous fossil bones . . . . . | 3 " 20 |
| 5. | Fine white silt, generally similar to the third member, but occasionally interstratified with sand and graduating downward into coarse sand and gravel . . . . | 10 " 200 |
| 6. | An unconformity. | |
| 7. | A series of white silts and brown sand, apparently duplicating the deposits from 1 to 5, inclusive, dissected by inter-lacustral erosion, and appearing only in the cañon bottom . . . . . | 0 " 100 |

The deposits above the unconformity represent the later period of cold and wet; the unconformity represents the inter-lacustral period of

warm and dry climate; and the lower series was accumulated during the earlier period of enlarged glaciers and expanded lakes.

I forded the river to reach a little park on the northern side, formed by the expansion of the inner gorge, just above the greatest constriction of the outer canon and bounded by precipitous walls of silt and sand. This park lies 12 miles in an air line from the mouth of the river and half a mile above an immense salient of red-brown loam and sand which our party had previously christened the "Vermilion Cliff" (see Fig. 2). Three hundred yards east of the Vermilion Cliff there is a little butte of snow-white silt, 30 feet high and 300 feet in circuit, rising from the ferruginous ossiferous sand; and about the base of the butte many bones were found.[3] Riding around it, a slight projection, like the tip of a slender bone, 5 feet above the base and 25 feet below the summit, caught my eye, and on examination was found to be the tip of the implement illustrated in Fig. 1.[4]

Appreciating the significance of the discovery, I at once sought to devise means of securing corroborative testimony; but I was alone; the camp of my side party was five hours' ride distant, and no one was there but my packer; probably no other white man could have been found within a day's journey; there was no photographic apparatus in the side party; and it was the last day of a side trip and necessary to break camp immediately on my return in order to join the main party at a specified rendezvous 50 miles distant; and so the hope of corroborative testimony was reluctantly abandoned. But before extracting the object a number of hypotheses as to the manner in which it might have become imbedded were formulated, in order that the validity of each might be tested in the process of removal. Among these were the following: (1) That it was embraced in a veneer of mud such as sometimes forms on vertical cliffs of unconsolidated materials during or after rain storms; (2) that it was imbedded in a pseudo stratum of debris blown or washed into a horizontal crevice in the face of the cliff; (3) that it had worked down a burrow once communicating with the surface and now exposed by the recession of the cliff; (4) that it had fallen into a vertical or oblique fissure or joint such as sometimes intersects the deposits in the vicinity; and (5) that it had been shot or otherwise projected into its position either alone or attached to a shaft which subsequently became dislodged. After spending perhaps half an hour in reflection, I proceeded to exhume the object by cutting away the sun-dried silt carefully, bit by bit, with the blade of a pocket knife. During this process the first four of the foregoing hypotheses were found to be disproved by the absence of a mud veneer and by the homogeneity of the finely laminated deposit, while the fifth appeared to be disproved by the position of the implement, which was nearly horizontal (the large axis inclined perhaps $10^{\circ}$ toward the stem), with the tip projecting less than a third of its length from the face of the cliff. The relation of the object to the minor structure was studied in order to ascertain whether the laminae were disturbed in such manner as to suggest either impact of or deposition over the object; but the results were not decisive.

The implement is represented full size in Fig. 1. It is of massive obsidian, or volcanic glass, and quite free from superficial incrustation or disintegration. In material, size, general form, mode of chipping, and

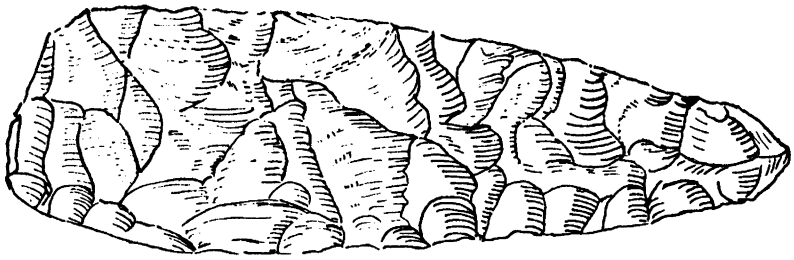

Fig. 1 — Obsidian implement from Walker Valley, Nevada.

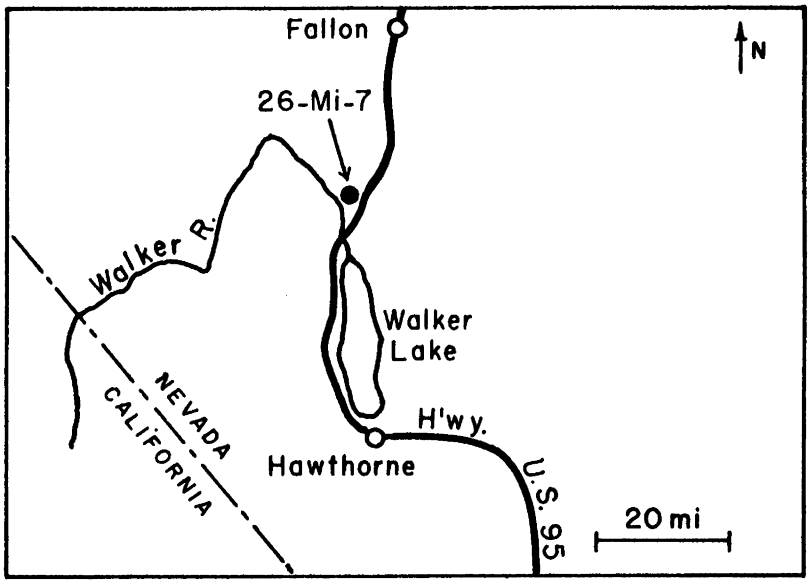


Fig. 2 — Sketch showing approximate location of site 26-Mi-7.

freshness in appearance it is undistinguishable from the arrow points in use to-day by the Piute Indians of the vicinity. It should be mentioned that this fresh aspect is paralleled by that of the fossil bones found in the same stratum of white silt. These bones are perfectly white, not at all mineralized and, when found in fragments not readily identifiable, may easily be discriminated from long-weathered recent bones by their greater porosity and less weight.

The upper series of Lahontan deposits within which the obsidian was found are classed as Pliocene (Equus beds) by the vertebrate paleontologist and later Pleistocene by the physical geologist; but this discrepance is of no further significance than an indication that the chronologies of paleontologist and geologist do not coincide. It suffices that the later episode of cold and wet in the Lahontan basin has been demonstrated by King, Gilbert, and Russell to correspond with the second ice invasion of the glacial epoch.

The delay in publishing a detailed autographic account of the discovery was not due to neglect. The object and the notes of its finding were duly conveyed to the chief of party in charge of the surveys in Lake Lahontan, Mr. I.C. Russell, of the U.S. Geological Survey, but with serious misgivings as to the propriety of publication; the reasons for which are stated below. After consideration, Mr. Russell decided to publish, and so the implement is figured, and the deposits in which it was found and the fauna with which it was associated are described, in his Geological History of Lake Lahontan (Monographs of the U.S. Geological Survey, Vol. IX, 1885, p. 247). About the time this matter went to press, Mr. G.K. Gilbert, the chief of the division in which the work was carried on, recommended publication in a more detailed manner and in a medium more generally accessible to anthropologists; and in consequence of this recommendation the oral communication, of which this is a revised abstract, was presented before the Anthropological Society of Washington November 16, 1886. A notice of this communication (prepared by Mr. Nelson H. Darton, but published anonymously) appeared in the Scientific American Supplement, Vol. XXIII, 1887, p. 9221, and was republished in Nature, Vol. XXXV, 1887, p. 476. Several references to the discovery have since been made in different scientific publications -- e.g., in the American Naturalist, Vol. XXXI, 1889, p. 458, and Proceedings of the American Association for the Advancement of Science, Vol. XXXVII, 1888, p. 295. The author has hitherto made published reference to the matter in the Popular Science Monthly, Vol. XXXIV, 1888, pp. 23, 25, 27, and 29. Thus the discovery already has a definite place in scientific literature.

By reason of these advance publications, the author has had perhaps unexampled opportunities for observing the reception of the discovery by scientific men; and it is perhaps an unprecedented circumstance that he finds his evidence receiving greater weight and more ready acceptance from others than from himself. And by reason of his own agency in the matter he can freely discuss the validity of the testimony and its relevancy to the great question of the antiquity of man without engendering personal feeling. So some of the principles which it is believed ought to guide and guard judgment in all cases are appended.

It is a fair presumption that any unusual object found within, or apparently within, an unconsolidated deposit is an adventitious inclusion: Every cautious field geologist accustomed to the study of unconsolidated superficial deposits quickly learns to question the verity of apparently original inclusions; he may, it is true, exhaust the entire range of hypotheses at his command without satisfying himself that the inclusion is adventitious; yet he is seldom satisfied that he has exhausted the range of possible hypotheses as to the character of the inclusion, and hesitates long before accepting any unusual association as veritable. His case is not that of the invertebrate paleontologist at work in the Paleozoic rocks, to whom a single fossil may carry conviction; for not only are the possibilities of adventitious inclusion indefinitely less in solid strata, but the mineral character of the fossil is commonly identical with that of the matrix and so affords inherent evidence of the verity of the association. Nowhere, indeed, in the entire range of the complex and sometimes obscure and elusive phenomena of geology is there more reason for withholding final judgment based upon unusual association than in the unconsolidated superficial deposits of the earth; and it is only where there is collateral evidence that such testimony is acceptable to the cautious student. Now, the sediments of Lake Lahontan are generally, and in Walker river cañon almost wholly, unconsolidated, and so the probabilities are against the verity of the association.

It is a fair presumption that an isolated association is adventitious: Nature is prodigal of phenomena and consistent in operation, and these facts are so fully recognized by rational beings that they esteem lightly an observation which cannot be repeated. The first step in inductive science is observation and the second is generalization, and if only a single observation be made induction fails; it is true that imagination may span continents, bridge oceans, roam the heavens, and produce additional phenomena upon which generalization may be propped, but faulty observation and far-fetched generalization are the bane of science. When the age of a rock formation is in question, it is not the finding of one but of many fossils, and not by one individual but by all individuals who may see fit to visit the locality, that the question is decided; when Huxley demonstrated the affinity between man and the anthropoid apes, it was not by one but by many anatomic preparations, certified not only by his own observation but by that of all anatomists who chose to examine them; even a discovery of so little immediate importance to man as that of an asteroid, a comet, or the satellite of a distant planet, is not accepted on the testimony of a single observation and finds no place in science unless all other suitably equipped observers can repeat the observation; indeed, in the whole range of conservative science, no weighty conclusion is based on a single observation. Now, the sediments of Lakes Lahontan and Bonneville are laid open by numberless cañons and ravines; a dozen geologists have worked for weeks or years over these superb exposures; innumerable fossils, scores of minute flexures and faults, several unique minerals, and dozens of museum cases full of the freaks of segregation and crystallization have been found; but only a single trace of man has been brought to light. The force of the testimony offered by the Nevada obsidian is greatly weakened even by the fact that its discoverer spent several days before and several hours after the discovery in careful scrutiny of the deposit whence it came without finding other traces of human life.

It is a fair presumption that an incongruous association is adventitious: Natural phenomena are intimately related and commonly represent links of definite sequence, and this harmony is consciously or intuitively recognized by rational beings; and so discord engenders a suspicion that the prevailing harmony has been adventitiously interrupted. The botanist has a term for sports and the zoologist for monstrosities; the physicist recognizes the aberration of sound; and the paleontologist is constantly confronted with anachronisms in the distribution and sequence of organic life; but these interruptions of prevailing harmony in nature are only considered abnormal with respect to certain laws and are collated and systemized as bases for other laws. Yet the incongruous association is not commonly accepted as a basis for generalization unless its verity be established by collateral evidence. Now, the archaeologists of the present generation have shown that man passed through certain stages of culture which correspond vaguely with certain episodes in the Pleistocene history of the earth; that in general paleolithic art preceded neolithic art, and neolithic art preceded the stage of varied industries and manufactures; and in a general way that the contemporaries of the Lahontan mammalia used paleolithic implements, while the users of finely chipped obsidian implements are quite recent; and so the testimony offered by the Nevada obsidian is weakened by the incongruous association. It has already been pointed out that "the apparently conclusive structural evidence of the antiquity of the Nevada obsidian is opposed by its fresh aspect and modern form." (Pop. Sci. Mon., Vol. XXXIV, 1888, p. 25)

So, despite the fairly complete structural evidence as to the verity of the apparent association of the Nevada obsidian, the unconsolidated condition of the deposits, the isolation of the occurrence, and the incongruity of the relations, all indicate that the association is adventitious and valueless to anthropology. Yet this conclusion is subject to several qualifications.

In inductive science the value of evidence varies with its volume, its consistency, and its cumulative character: It is a primitive doctrine, born of crude conceptions, nurtured by ecclesiastical dogma, and fostered by juridical necessity, that all evidence is either strictly true or wholly false, and moreover that final judgment must be reached in each case howsoever incomplete the available evidence may be; and the commonly accepted rules of evidence form a device for sifting testimony, detecting error and mendacity, and reaching final judgment despite the insufficiency or contradictory character of the available evidence. But the doctrine and the method growing out of it are eminently unscientific. Inductive science affords a method of reasoning from particular phenomena to general relations and principles; each phenomenon is an unimpeachable witness whose testimony can be fully interpreted only in terms of that of related phenomena; the witnesses gather strength and intelligibility with numbers; and it is the great merit of the inductive method that final judgment may, and indeed must, be postponed until the evidence is complete. An isolated sport may be meaningless to the botanist, but a score may form a basis for a valuable generalization, and a hundred may bring to light an important principle; the first crude observations on meteorites only gave play to vague fancies and added nothing to exact knowledge, but extended and systematic study of these always incongruous apparitions, at the hands of Smith, Newton, Roche, Lockyer, G.H. Darwin,

and others, has resulted in one of the most notable advances in science of the century; the finding of the first Eocene fossil in the Pliocene phosphate beds of South Carolina was simply a puzzle to Toumey, but the finding of hundreds of the older fossils in the newer deposit has thrown more light on the conditions of origin of an interesting deposit than all of the more congruous discoveries combined; and so in each branch of science, isolated observations may be at first incongruous, but become consistent and significant with multiplication, and finally by the cumulative character of their combined testimony form bases for new generalizations and new principles. Now at the time of the Nevada discovery it was nearly isolated both in geography and geochrony, and thus of little significance; but since that time Abbott's discoveries in the Trenton gravels have been verified and repeated by a score of students, Miss Babbitt's discovery of quartz chips in the Mississippi terraces have been made and verified, the Ontario hearth has been discussed by a trained geologist, and the Metz paleoliths have been exhumed from the glacial gravels of southern Ohio; these discoveries extend over a considerable part of the country and were made in deposits of definitely determinate age; and it is a fact of prime importance that these deposits are coeval among themselves and with the beds yielding the Nevada obsidian. So the otherwise doubtful evidence of the discovery gains strength from the consistent and cumulative evidence of other discoveries in different parts of the land.

In inductive science the sufficiency of a given body of evidence varies inversely with the importance of the conclusion to which it leads: A single fossil or a dozen fossils may suffice to determine the age of a local formation in which a score of students are theoretically interested (and the restricted significance of the conclusion is intuitively, though perhaps unconsciously, recognized by the students when it is formed), yet tens of thousands of fossils have not sufficed to satisfy conservative geologists that any great rock group of America is exactly coeval with the corresponding group in Europe; every naturalist had long recognized, and none disputed, the existence of individual variation among plants and animals, yet when the law governing such variation was formulated and implanted in the philosophy of science by Darwin, it required the carefully recorded and freely discussed observations of a generation of naturalists to establish the conclusion; in early days the testimony of the ever-varying hand or foot or forearm or stride sufficed to settle questions of linear measure, but with the increase in value of lands and commodities the bases of linear measure have been refined to a degree incomprehensible to uncivilized man; and while idle figments of untrained imagination formed a sufficient basis for primitive folk-lore, the best efforts of the highest powers of observation and reasoning are required to form the basis of its colossal offspring, the philosophy of modern science. In exact thought conclusions are not of like weight,and demonstrations are not of equal facility; judgment is not a tangible entity which exists but once and for all time, but an ever-varying standard of measure; and the acceptability of every conclusion depends in part upon its consequences. Now anthropology is perhaps the foremost branch of science, and perhaps the most important question in anthropology relates to the origin and antiquity of man; and by reason of the perhaps unequalled importance of the question, it is desirable that evidence concerning it should be carefully scanned as to quality and carefully measured as to quantity.

Moreover, such evidence may be insufficient concerning one phase of the subject, yet at the same time sufficient concerning another phase -- e.g., it would be logical to accept the testimony of the Nevada obsidian as to the cultural status of a possible Pleistocene man and at the same time to reject its unsupported testimony as to the existence of Pleistocene man; or it would be logical to reject the testimony of the implement as a basis for any sweeping conclusion as to the origin, antiquity, or early condition of man, and yet place it on record as a silent witness whose testimony may become of value with further research.

In inductive science every conclusion is tentative: The primary object of research is to determine the relations among phenomena, first, through observation, and second, through generalization. But it frequently happens that the generalization based on a limited number of observations is materially modified by one or two additional observations, and so the conservative student learns to proceed cautiously, to constantly spur observation and check generalization, and to modify his judgment with each new acquisition of evidence. In the days of the Lyellian classification of the Tertiary formations by ratios of contained fossils, certain formations of the Atlantic slope were thrown alternately into the Miocene and Pliocene, according to the varying success of successive collectors in gathering and identifying the fossils; the asteroid hunter carefully notes the position of the unfamiliar celestial body, and then calmly awaits opportunity for further observation before making final entry in the record of the known solar family; and the naturalist penetrating previously untrodden wilds fixes mentally the habitats of a score of species as tentatively determined by each day's study, yet makes no final record of any until his work is done, and then holds his conclusions subject to modification by any subsequent observer. Indeed, no conclusion in inductive science can be final and unassailable until the cosmos is encompassed and all the relations of each natural phenomenon to all other phenomena are made known. Now the Nevada obsidian is an isolated and incongrous phenomenon, and any judgment concerning it must be of relatively little weight and subject to modification with new discoveries, and it is perfectly logical to accept the verity of the association and record the fact of its finding, yet to withhold immediate judgment as to its significance and allow the interpretation placed upon it to vary with the progress of discovery, either in the same deposit or in other parts of the country.

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By reason of his recognition of the foregoing principles the discoverer of the Nevada obsidian was long disposed to confine the record of the finding to his note-book pending further discovery, and it was with reluctance that the record was first published; but, still in accordance with these principles, he considers the testimony of the object to have acquired value through the corroborative testimony of other discoveries; and, again, in accordance with the same principles, he to-day regards it as indicating feebly the contemporaneity of man with the elephant, ox, and camel of the later Pleistocene lake epoch, and almost as feebly (in view of the weight and a priori improbability of the conclusion), that this early man was Neolithic.

The substance of the above paper was read before the (Anthropological Society (of Washington) November 16, 1886. In the discussion which followed Mr. Gilbert (see page 33) remarked, in part, as follows:

"The striking peculiarity of the Walker find is the rare, if not unique, combination of circumstances affecting its authenticity as an evidence of the geologic antiquity of man. The object is one indubitably made by man; it was found in situ; it was found in a formation of well-determined date; it was found by a trained observer; and finally, that observer recognized the importance of the discovery before he disturbed the matrix inclosing the implement."

The end.

NOTES

1. This article, reprinted from the American Anthropologist, Vol. II, October, 1889, is an excellent example of the careful consideration given to an isolated archaeological find. Its particular value lies in its treatment of a subject which was and is to this day sometimes fraught with emotion or premature enthusiasm: the antiquity of man in the New World.

2. William John McGee (1853-1912), signed his name W J McGee, without periods. He was connected with the U.S. Geological Survey from 1883 to 1893. From 1893 to 1903 his affiliation was with the Bureau of American Ethnology, where he served for a time as acting director, during part of Major J.W. Powell's tenure as director.

3. This site has been assigned the symbol 26-Mi-7 in the files of the University of California Archaeological Survey.

4. The specimen is illustrated also in Holmes, W.H. Handbook of Aboriginal American Antiquities. Smithsonian Institution - Bureau of American Ethnology, Bulletin 60, p. 68. Washington, D.C., 1919.