Fluted Projectile Points: Their Age and Dispersion

Stratigraphically controlled radiocarbon dating provides new evidence on peopling of the New World.

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Problems of age, classification, and dispersion of fluted projectile points in eastern North America have been extensively discussed in a recent review by Mason (*1*). The results of geological and archeological investigations in the High Plains and the Southwest are in accord with most of the interpretations presented in Mason's study. With the possible exception of Sandia points, the earliest projectile points in any stratigraphic context are Clovis. These are characteristic of the Llano complex—artifacts of a people who specialized in hunting mammoths. Some archeologists interpret variations between Clovis fluted points of the High Plains and Southwest and fluted points of the eastern United States as indication of temporal as well as typological differences (*2*), and argue that the eastern specimens are ancestral to Clovis points, because of the latter's late position in an *inferred* developmental sequence. Other archeologists recognize minor differences but do not consider Clovis points typologically different from eastern fluted points such as Enterline, Bull Brook, and some points from the Great Lakes region (*1*, *3*); they argue that, without supporting geochronological evidence, temporal differentiation is not justified. They therefore use the name *Clovis* to include related eastern projectile points (*1*). Close inspection of Clovis point collections from the Dent (Colorado), Miami (Texas), Blackwater No. 1 (New Mexico), Naco (Arizona), Borax Lake (California), and Williamson (Virginia) sites reveals that variations within individual collections are as great as variations between collections, and most of the individual Clovis points clearly display a multiple-fluting technique (see cover) similar to that described for fluted points from Michigan (*4*) and from the Shoop (Pennsylvania) and Bull Brook (Massachusetts) sites (*5*). In the light of these findings and of results of radiocarbon dating interpreted in terms of stratigraphy, I examine, in this article, the hypothetical possibilities if we consider Clovis points, and similar points found from coast to coast, to be representative of a single people.

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Age of Clovis Sites

Of six sites in the High Plains and Southwest where Clovis artifacts have been found *in situ* (*6*, *7*), five have now been dated by the radiocarbon method. From the Lehner site in Arizona (Fig. 1*D*) improved counting techniques have clearly shown earlier dates obtained by the solid-carbon method to be in error (*8*). Statistical treatment of six dates from the Clovis level has demonstrated excellent agreement between results for individual samples and among separate laboratories and provides an average age of 11,260 ± 360 years (*9*). Overlying and underlying sediments (samples A-33 bis and A-478*b*) have been dated 10,410 ± 190 (*10*) and 11,600 ± 400 years ago, respectively (*11*).

The Dent site in Colorado (Fig. 1*A*), where Clovis points were first found *in situ* and in association with mammoth remains, has been dated by the radiocarbon method mainly through the efforts of George Agogino, director of the Paleo-Indian Institute, Eastern New Mexico University. A mammoth mandible from the original excavation was made available for analysis by H. M. Wormington, curator of archaeology at the Denver Museum of Natural History. The bone, after being pulverized, was leached with alcohol and then with acetone in order to remove organic preservatives. The progress of the leaching was monitored through periodic analysis for nitrogen and organic carbon. The bone was then pyrolyzed and leached with hydrochloric acid to produce a residue of "bone black" carbon. Bone from which the preservatives had not been leached (sample I-473) was dated 7200 ± 200 years ago, while the leached sample (I-622) was 11,200 ± 500 years ago.

As a result of intensive archeological and geological activities during 1962–63 at Blackwater No. 1 (Fig. 1*B*), the Clovis type site, our knowledge of the Llano complex (*6*, *7*) has been substantially increased (*12–14*). These activities produced materials suitable for radiocarbon dating from both the Clovis and the Folsom levels (*9*). Excavation of the skeleton of a mammoth produced carbonized plant remains in a clay lens deposited in and around the skull soon after the animal had fallen prey to the Llano hunters. The age of 11,170 ± 360 years obtained for sample A-481 dates the filling of the mammoth's brain case with lacustro-fluvial sediments and provides an early date for the deposition of sediments probably equivalent to the "brown sand wedge" of Evans (see *6*, p. 28). Detailed geological investigations in Blackwater Draw indicate the underlying "gray sand" unit, in which many of the Clovis artifacts and associated mammoths occur, to be considerably older than the cultural material (*15*)—that is, the artifacts and at least some of the animal remains have intruded the gray sand.

A diatomite stratigraphic unit at Blackwater No. 1 overlies the Clovis material and contains Folsom artifacts and associated bison remains. Carbonized plants from this unit have provided dates of 10,490 ± 900 (A-386) and 10,250 ± 320 years (average of A-379 and A-380) (*9*). These are comparable to dates for other Folsom material.

At the Naco site in southeastern Arizona (Fig. 1*C*) disseminated flecks of charcoal collected from alluvium containing a mammoth and associated

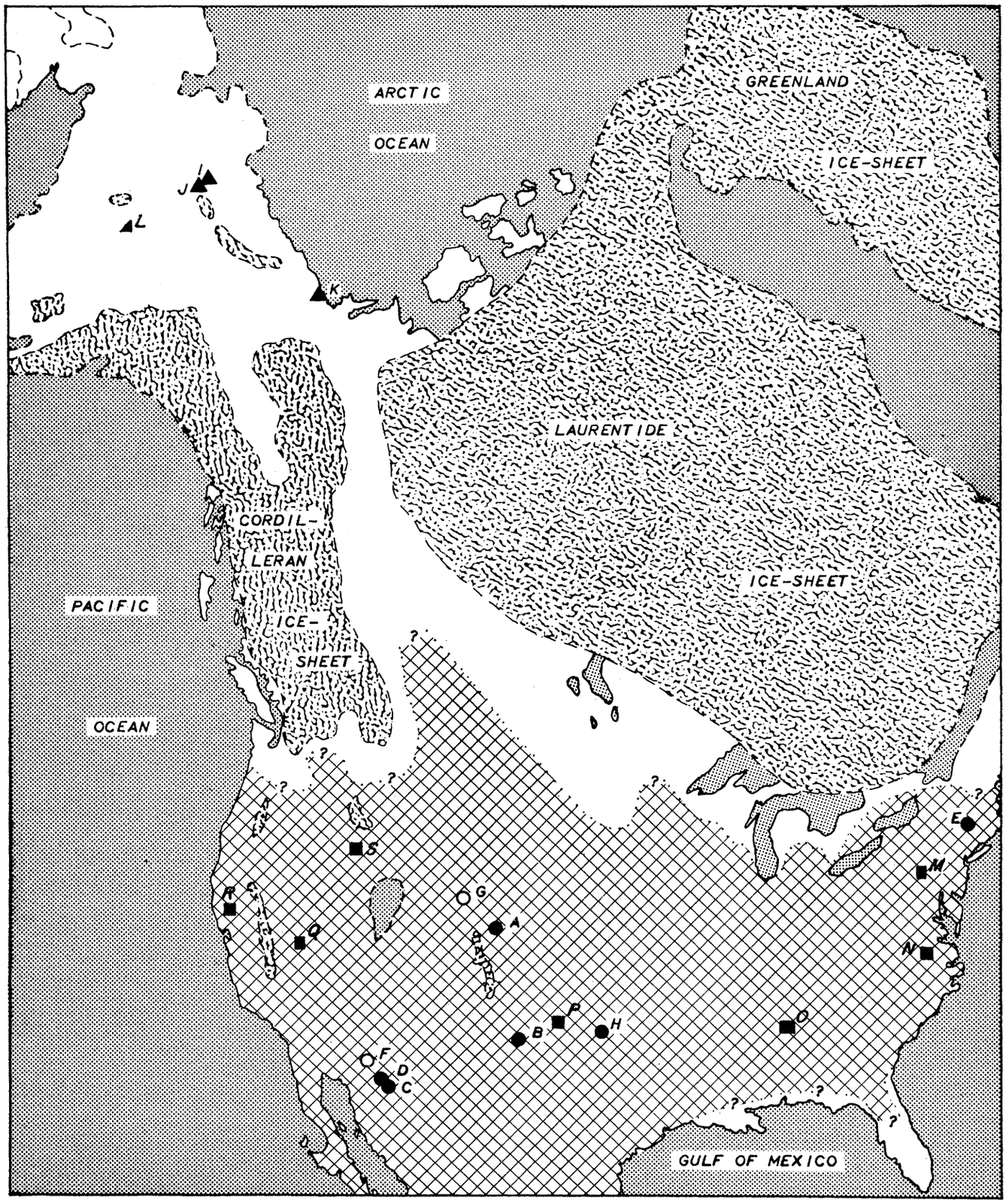

Fig. 1. Map showing (solid circles) radiocarbon-dated Clovis sites; (open circles) possible Clovis sites, radiocarbon-dated; (squares) Clovis sites not dated; (triangles) sites in the Far North where fluted points have been discovered; and (grid pattern) distribution of Clovis points found on the surface—all in relation to the approximate ice border during Two Creeks time and the Bering land bridge when sea level was 55 meters lower than it is now. *A*, Dent site, Colorado; *B*, Blackwater No. 1 site, New Mexico; *C*, Naco site, Arizona; *D*, Lehner site, Arizona; *E*, Bull Brook site, Massachusetts; *F*, Ventana Cave, Arizona; *G*, Union Pacific Mammoth site, Wyoming; *H*, Domebo site, Oklahoma; *I* and *J*, Alaskan surface finds; *K*, Engigstciak site, Yukon Territory; *L*, Iyatayet site, Alaska; *M*, Shoop site, Pennsylvania; *N*, Williamson site, Virginia; *O*, Quad site, Alabama; *P*, Miami site, Texas; *Q*, Tonopah site, Nevada; *R*, Borax Lake site, California; *S*, Simon site, Idaho.

Clovis points were dated 9250 ± 300 years (A-9 + 10), but both the nature of the occurrence and the solid-carbon method of dating leave the date open to question (*16*). Geological evidence indicates that it is of the same age as Clovis material from the Lehner site.

The Domebo site (Fig. 1*H*), near Stecker, Oklahoma, is a recent discovery of mammoth remains with associated fluted points that Anderson (*17*) considers to be Clovis, with typological variations approaching those observed on some Plainview points. Wood samples (SM-610 and SM-695) from a silt-clay unit containing the association have been dated 10,123 ± 280 and 11,045 ± 647 years, respectively, the latter date being considered more pertinent to the mammoth-man association.

One other dated site that may contain a Clovis occupation is Ventana Cave, Arizona (Fig. 1*F*); charcoal (A-203) from the "volcanic debris" unit (*18*, *19*) at this site was dated 11,300 ± 1200 years (*10*). Deposition of this unit was followed by a period of erosion, then by deposition which Bryan (see *18*, p. 126) has attributed to the Altithermal. It appears, therefore, that the volcanic debris covers a time span of several thousand years. A projectile point from this stratigraphic unit shows affinities with both Clovis and Folsom points; however, Haury (*19*) points out that the age obtained by radiocarbon dating, the paucity of Folsom points in southeastern Arizona, and the small size of some known Clovis points all indicate the Ventana specimen to be Clovis.

A Clovis site in the eastern United States, the Bull Brook site (Fig. 1*E*) in Massachusetts, has provided four dates from scattered lumps of charcoal (*20*). The dates range from 6940 ± 800 years (sample M-809) to 9300 ± 400 years (M-807), but their applicability to the artifacts has been questioned (*1*).

Age of Folsom Sites

Exclusive of caves, there are eight sites where Folsom artifacts have been found *in situ*. For five of these, including Blackwater No. 1, dates have been obtained by the radiocarbon method.

The earliest of these dates, 9883 ± 350 years ago, was obtained by the solid-carbon method on burned bison bone (C-588) from the Lubbock site in Texas (*21*). Subsequently a date of 10,780 ± 135 years was obtained for a sample (I-141) from the Folsom level at the Lindenmeier site in Colorado. This date permitted correlation of the geological stratigraphy at the Lindenmeier site with that of other important sites of early man in the western United States (*22*).

Recent investigations in Wyoming have led to the discovery of two new Folsom sites. The lowest cultural level at the Brewster site in eastern Wyoming contains Folsom points in association with remains of *Bison antiquus* and is overlain by several horizons containing Agate Basin points (*23*). A date of 10,375 ± 700 years has been obtained for the Folsom level (sample I-472), while two successive Agate Basin levels were dated 9900 ± 450 (M-1131) and 9350 ± 450 years (O-1252) (*24*).

At the Hell Gap site near Guernsey, Wyoming, Folsom and Hell Gap artifacts occur in the same stratigraphic unit. While no date has as yet been obtained for the Folsom level per se, a date of 10,850 ± 550 years obtained for Hell Gap material (sample I-167) applies equally well to the Folsom occupation, as determined from stratigraphic investigations (*25*). A loess deposit below the Folsom and Hell Gap level, but above a clay unit dated 13,060 ± 600 years (sample A-431), is correlated with a similar deposit near Rawhide Buttes, 50 kilometers away, that contains mammoth remains (A-366) older than 10,550 ± 350 years (*9*). At Hartville, 24 kilometers west of Hell Gap, a Clovis point was found in the same loess.

From the radiocarbon evidence it appears, if the Naco date is omitted, that the Folsom complex, representing bison hunters, has a relatively short time span of 1000 years between 10,000 and 11,000 years ago, and the Llano complex, representing mammoth hunters, a span of 500 years between 11,000 and 11,500 years ago. The transition from Clovis points to Folsom points occurred during a very short period, there being few known examples that might be considered transitional.

A review of the pertinent dates led Hester (*26*) to conclude that mammoths existed as late as 8000 years ago in the United States, but none of the dates earlier than 11,000 years ago are well established. With one exception all appear anomalous in the light of later radiocarbon dating and stratigraphic scrutiny. The Plainview, Texas, date of 9800 ± 500 years is for a sample (L-303) which was not in direct association with mammoth, and the complex stratigraphy at the site makes the association tenuous at best. The Kassler, Colorado, date of 10,200 ± 350 years is for a mammoth tooth (W-401), a material which is notorious for contamination with more recent materials. The Naco, Arizona, association has been questioned, as mentioned earlier. The one exception is Double Adobe, Arizona; there are now enough dates for that site to confirm the indicated age of 8000 to 9000 years for the Sulphur Springs deposits containing mammoth remains (*10*).

Other dates for mammoth remains—dates obtained later than those cited by Hester—are a minimum age of 11,900 ± 250 years (sample UCLA-637) for Tule Springs, Nevada (*28*), and an age of 11,280 ± 350 years for tusk (I-449) from the Union Pacific Mammoth site (see Fig. 1*G*) associated with nondiagnostic artifacts (*27*). The absence of mammoths from the United States by the time the Folsom and Hell Gap artifacts were deposited, 10,000 to 11,000 years ago, is evident in the stratigraphy of Paleo-Indian sites from Montana to Arizona, with the one exception of Double Adobe. Obviously, extinction of the mammoth population did not occur overnight, and it would not be surprising to find mammoth remains as young as 10,500 years, reliably dated by radioisotope and geological methods, but whether any mammoth remains are as recent as 8000 to 9000 years ago must be considered an open question. It appears, therefore, that the change from Clovis points to Folsom points coincides with the relatively sudden disappearance of mammoths, and the concomitant switch to hunting *Bison antiquus* in the High Plains suggests a change in the specialized hunting weapon in response to a change in game.

Clovis Dispersion and Glaciation

The maximum suggested age for Clovis points does not appear to be the result of premature interpretation because geological investigation of the known sites does not permit assumption of a date for the Llano complex earlier than 12,000 years ago. At sites where there are deposits immediately antedating the Clovis occupation these

deposits indicate ecological conditions as favorable to the existence of herbivorous megafauna, which man could hunt, as conditions during the time of the Clovis occupation, yet there is not the slightest evidence of man's presence. This is not meant to imply that there were no cultures in the New World earlier than 12,000 years ago, for there are good indications that there were (*29*). It simply means that we have no indisputable progenitor for the Llano complex. Thus we find Clovis points distributed over the southern half of the continent around 11,300 years ago. Why this apparently sudden appearance?

If we compare the geochronological data with glacial events in the Lake Michigan area, as recently reviewed by Broecker and Farrand (*30*), we find a striking relationship (Fig. 2). All dates for Clovis artifacts, with the exception of the Naco and Bull Brook dates, fall near or soon after the time of maximum advance of ice during the Valders stade, and all the dates for Folsom artifacts are well within the period of glacial recession. The seemingly abrupt appearance of Clovis sites in the High Plains and the Southwest during the Valders stade and after a period of glacial recession suggests that a relationship exists between the appearance of the Llano complex in the conterminous United States and the Two Creeks interstade, as considered by Hopkins (*31*). The distribution of Clovis points in relation to dates, obtained by the radiocarbon method, for ice and lake borders in the Lake Michigan area also suggests a Valders age, although a late Mankato age is also a possibility (*4, 32*). The fact that Edmonton, Alberta, is the most northern locality in which a Clovis point has been found (*7*, p. 42) is also pertinent.

From the glacial history of Canada and the Great Lakes area it now appears that by 12,000 years ago the eastern foothills of the cordillera and the western Great Plains of Canada (Fig. 1) were free of ice for the first time in some 15,000 years (*33*).

It is possible, therefore, that the Clovis progenitors entered the United States from Canada when an interglacier corridor opened up along the eastern foothills of the Canadian Rockies during Two Creeks time. From the seemingly rapid and wide dispersal of Clovis points, or of very similar forms, it appears that these people may have brought the technique of fluting with them.

Fluted Points in the Far North

Three fluted points have been found on the surface in northwestern Alaska: two in the western part of the Brooks Range (Fig. 1*J*) and one, the Utukok point, in the northwestern foothills of the range (Fig. 1*I*) (*34, 35*). The associations are tenuous, but two polyhedral cores were found in the same surface collections as two of the projectile points. All the points show multiple fluting and ground basal edges as do most Clovis points; however, one of the Alaskan specimens shows multiple fluting to a more pronounced degree than any Clovis point does. Three parallel flutes on each side of the Utukok point bear a marked resemblance to the flake scars left on a polyhedral core by the removal of blades, suggesting analogous techniques (*5*). In this case the point is simply a core from which blades are struck in the process of fluting.

A fluted point was also found at the Iyatayet site, Alaska (Fig. 1*L*), but whether or not it is actually a part

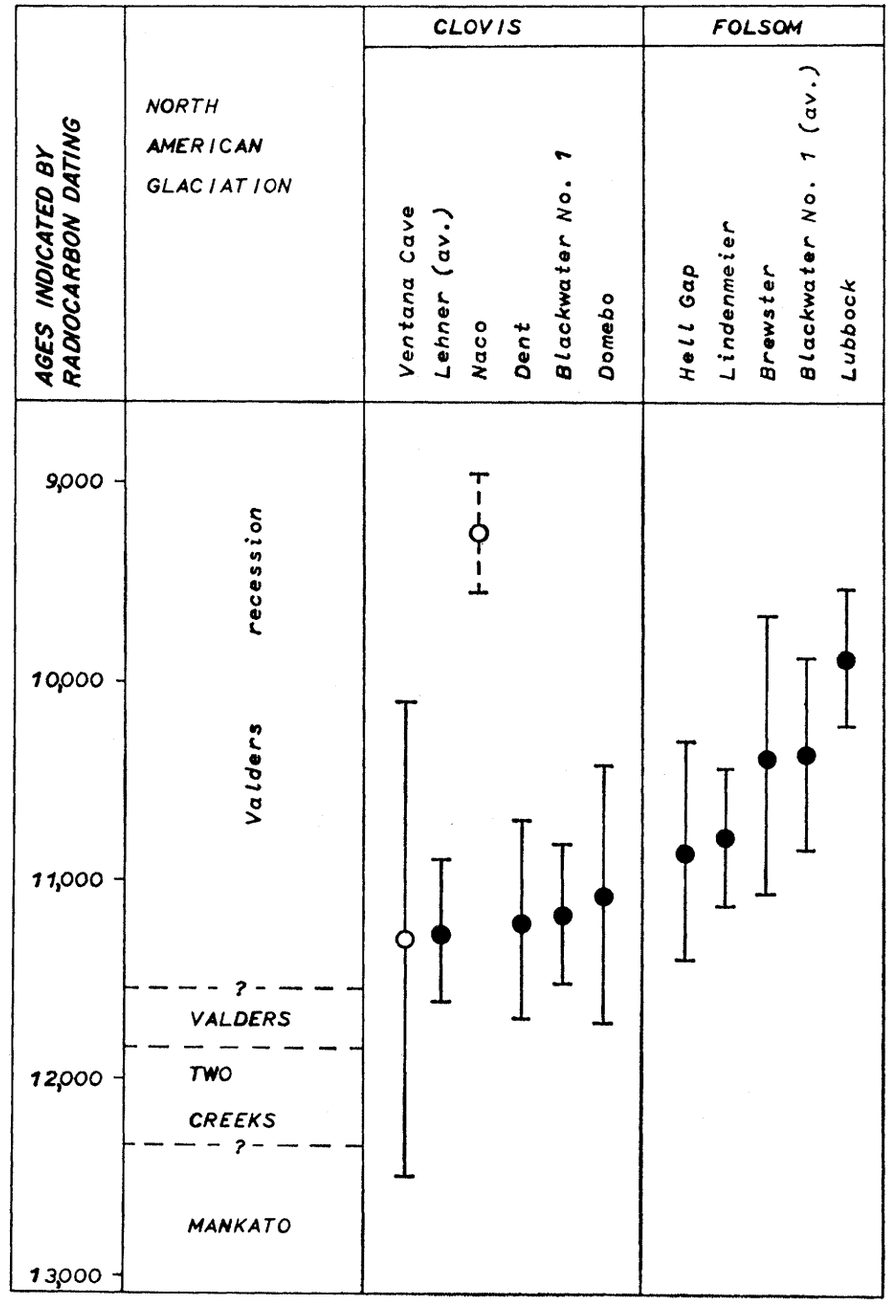

Fig. 2. Duration of Clovis and Folsom cultures, as revealed by radiocarbon dating, relative to late periods of glaciation in North America. [Glaciation data from Broecker and Farrand (*30*)]

of the Denbigh Flint Complex, dated 4500 to 5000 years ago, is open to question, as it is not uncommon for an artifact assemblage to contain anomalous specimens from an earlier complex (*36*). Crude fluted points from the Engigstciak site (Fig. 1*K*) near the Yukon arctic coast are believed to have been deposited soon after the last glaciation of the area (*37*). If this corresponds to the last glaciation recorded in the northeastern Mackenzie Delta, which ended before 12,000 years ago (*38*), the artifacts could be 12,000 to 15,000 years old.

In considering the origin of fluted-point cultures, the material from the Far North, while scanty and inconclusive, cannot be ignored. From a typological point of view the Utukok fluted point is more like Clovis than like Folsom points; the general shape, the percussion flaking, and the removal of three blades in fluting are all traits more akin to Clovis than to Folsom points. If the Utukok point differs from Clovis in age, it is probably older, as suggested by Witthoft (*2*), rather than younger; if it is older, the absence of fluted points from Siberia would point to the Bering land bridge, Alaska, or northern Canada as a possible place of origin for fluting.

Green (*13*) has suggested that a recent discovery of blades believed to be of Clovis age at Blackwater No. 1, New Mexico, may be the first tangible link in cultural tradition between the New World Paleo-Indian and the Upper Paleolithic blade industries of the Old World. The blades, polyhedral cores, and multifluted points of the Enterline Chert Industry may be quite as good a link as the Clovis blades (*2*), but, as emphasized by Wilmsen (*39*), the Alaskan and Canadian material supports the view that there were ties between the New World Paleo-Indian and the Siberian Upper Paleolithic blade industries.

In considering the distribution of Clovis points and the Alaskan and Yukon fluted-point finds in relation to late glacial geochronology we find a logical sequence of events, and the pieces begin to fall into place. If Clovis progenitors traversed a corridor through Canada around 12,000 years ago and dispersed throughout the United States south of the Valders ice border in the ensuing 700 years, then they probably were in Alaska some 500 years earlier—say, 12,500 years ago. The Alaskan fluted points and some of the polyhedral cores *could* represent this occupation and *could*, therefore, be ancestral to Clovis points and blades.

Both the Arctic slope and central Alaska were essentially ice-free during late Wisconsin time and could have been migration routes, but the known finds of fluted points suggest the northern route for Clovis progenitors. Furthermore, a tundra-covered area between eastern Siberia and western Alaska around 13,000 years ago, when sea level was 55 to 60 meters lower than it is today, would have presented no obstacle to people already acclimated to a tundra environment. Such an environment appears to have existed at Nome, across the arctic slope, and in the Canadian Great Plains during the recession of Wisconsin ice (*35*, *40*).

The dispersion of Clovis peoples in response to opening of a glacial barrier might explain the abrupt increase, at 10,400 years ago, in the number of dates shown in Libby's histogram of archeological dates obtained by the radiocarbon method (*41*). Five Clovis dates, extending the point of abrupt increase back to 11,300 years ago, can now be added. From at least 25,000 to 12,500 years ago, the trans-Canadian migration route was blocked by coalescence of the Cordilleran and Laurentide ice sheets. Therefore, any pre-Clovis archeological remains south of Canada probably derive from migrations earlier than "classical" Wisconsin time. The paucity of radiocarbon-dated sites older than 11,500 years suggests a sparse population at best.

According to the schedule proposed here, the dispersal of people ancestral to Clovis man from Siberia to the southwestern United States would have taken 1500 years and would represent a unique "migration," as suggested by Green (*13*). Once south of the ice border, Llano man dispersed from California to Massachusetts and southward into Mexico (*6*), in less than 1000 years. The subsequent spread of early cultures throughout the New World between 11,000 and 10,000 years ago attests to the rapidity with which aboriginal bands could disperse in the pursuit of big game—first mammoths and then bison.

Summary and Conclusions

The stratigraphic record shows Clovis projectile points to be restricted to sediments between 11,000 and 11,500 years old. Underlying deposits dating back 11,600 to 13,000 years are without evidence of human occupation. In the High Plains, overlying deposits dating back 10,000 to 11,000 years contain Folsom and Hell Gap artifacts and are without mammoth remains.

The glacial history of Alaska, Canada, and the Great Lakes region indicates that, for the first time in at least 15,000 years, an ice-free, trans-Canadian corridor opened up approximately 12,000 years ago. Since Clovis points are distributed from coast to coast south of the Valders ice border, the abrupt appearance of Clovis artifacts in the stratigraphic record of the High Plains some 700 years later suggests that Clovis progenitors passed through Canada during Two Creeks time. If eastern fluted points (for example, Enterline) are older than Clovis points, the difference may be on the order of only a hundred or so years, not thousands.

The change from Clovis points to Folsom points in the High Plains may be related to a marked decline in the mammoth population after 11,000 years ago, but whether or not man was a prime factor in the extinction of Pleistocene megafauna is a moot question.

On the basis of new data and critical geological evaluation of dates obtained by the radiocarbon method a hypothesis has been offered to explain (i) the abrupt appearance of Clovis points in the stratigraphic record of the United States around 11,500 years ago, and (ii) the lack of a cultural continuum in the United States leading to fluted projectile points. Llano hunters, like the game they pursued, may have persisted longer in some areas of the continent (for example, Bull Brook) than in others, but if a Clovis site can be found for which good stratigraphic evidence supports a date earlier than the Two Creeks interstade, then correlation of this event to the opening of the trans-Canadian ice-free corridor is incorrect (see *41a*). Such a misinterpretation of timing would not affect the explanation for the lack of Clovis progenitors in the United States. We must continue to look for an indigenous cultural continuum leading to Clovis points, but if such cannot be demonstrated in the conterminous United States, then it would appear that fluted projectile points were developed elsewhere. Clovis progenitors might best be sought in northern Alaska or the Mackenzie Valley.

The interpretations offered here are based on new data and critical geological evaluation of dates previously obtained by the radiocarbon method. How valid these interpretations are can be ascertained only through careful scrutiny of all man-mammoth associations found in the future, to assure precise relating of dates, fossils, and artifacts to the stratigraphic framework. We must pay closer attention to stratigraphic detail if we are to make the fullest use of radiocarbon dating.

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41a. My attention has been called to a pertinent paper by O. H. Prufer and R. S. Baby [*Paleo-Indians of Ohio* (Ohio Historical Society, Columbus, 1963)]. These authors interpret the distribution of some fluted points in relation to glacial moraines and ancient beach ridges as evidence for occupation of Ohio by makers of fluted points before the Two Creeks interstade. The geochronology of fluted points in the East has been plagued by the almost total lack of stratigraphic context that would permit definitive estimation of age. In the absence of such context, much reliance has necessarily been placed upon the surface distribution of fluted points in relation to datable geomorphic features, but as Prufer and Baby state (p. 53), "mere association with a certain beach system [or moraine] does not preclude the possibility that a specimen so discovered postdates the formation of this particular system; such association merely implies a maximum date." It should be added that the temporal position of the geomorphic features themselves is not adequately known. For the moment it appears that fluted points occupy the base of projectile-point sequences, but the definitive age of fluted points in the East must await the finding of more sites with stratigraphically controlled dates and artifacts.

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A Measure for Crackpots

How does one distinguish between valid scientific work and counterfeit "science"?

Fred J. Gruenberger

For every article one sees in a technical journal or, for that matter, even in the public press, a decision has to be made: Is this worth reading or is it something that can safely be skipped? It would seem that there is no acid test or even a small group of tests which will serve to distinguish infallibly between crackpot work and good science. For every criterion that is advanced one can quickly think of a counter example. Every idea that is offered to us falls somewhere between the two extremes. Since there is no single test, the best that can be done is to offer a checklist of some of the attributes of science and of the crackpot to help in making this decision.

Let me illustrate what I mean by the failure of any single test. A scientist generally strengthens his stand greatly by his ability to predict. Einstein's early work in the general theory of relativity gained credence by accounting in part for a known error in the perihelion of the planet Mercury. His theories gained real acceptance, however, many years later when British astronomers (during World War I, when Einstein was a citizen of an enemy country) verified by direct observation his statements about the previously unsuspected bending of light in a gravitational field. Here was the principle of predictability used to the fullest.

If predictability is to be used as a

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