# *Hominids, Pebble Tools and the African Villafranchian*[1]

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THE greatly accelerated pace of prehistoric research in the postwar years has made it necessary to reexamine certain problems in paleoanthropology. This is especially true for Africa where primitive hominids and pebble tools have been discovered in deposits of recognized Villafranchian age. These discoveries raise the question of the relationship, if any, between these earliest stone implements and the Villafranchian hominids. A related problem is the place of the Pliocene-Pleistocene boundary and the age of the Villafranchian stage in Africa with reference to the Pleistocene sequence in other parts of the Old World. A review of the evidence for Pleistocene man south of the Sahara will be presented at another time, but it is worth while here to clarify certain points about the Villafranchian stage in Africa in view of some misconceptions present in the literature.

The first evidence of tool-making is found in deposits of the first pluvial (Kageran) stage in equatorial and southern Africa. Pebble tools of this age have been found on the eastern shores of Victoria basin at Kanam (Leakey 1936*a*, 1936*b*), and in the Kagera and Kafu river valleys west of the basin in Uganda (Wayland 1934; Lowe 1952); artifacts of comparable age have recently been found sealed *in situ* in ancient gravel deposits in the Vaal river basin (Lowe 1953). These implements, referred to the Kafuan stage of the Pre-Chelles-Acheul industry, were manufactured from waterworn pebbles of quartz or quartzite with stone percussion flaking in one direction, and on only one side, to produce a single, adze-like cutting edge. Although artifacts of Kafuan type are found rolled and abraded in deposits of post-Kageran age at various localities south of the Sahara, the industry may well be restricted to the first pluvial stage.

The Oldowan, a derivative stage of the African Pre-Chelles-Acheul, is found in deposits of the early part of the second pluvial (Kamasian) stage. Some Oldowan implement types are found in the final phases of the Kafuan (Lowe 1952), however, so it is possible that this industry had its beginnings in the later part of the first pluvial stage. This problem may be clarified by future field work in northwestern and central Africa. Pebble tools of first end-pluvial age (Kageran-Kamasian interpluvial) have been found recently in southern Morocco (Mortelmans, Choubert and Hollard 1952) and also in the vicinity of Casablanca (Biberson 1953). An industry termed the Kafilian, more advanced than the Kafuan, is known from the Congo and is of the same approximate age (Mortelmans 1947, 1949). These assemblages may well fill the gap between the Kafuan and the Oldowan.

In the Oldowan, pebbles and other nodular raw materials were flaked by stone percussion in two directions, and on both faces, to produce a crude sort of chopping tool; some flake implements with wide-angled, unprepared striking platforms are also found in Oldowan assemblages (Clark 1950). The Oldowan is known from sites around the Victoria basin (Lowe 1952), from old river gravels in the Congo (Mortelmans 1947, 1949), in Angola (Leakey 1949), in the Rhodesias (Jones 1949; Clark 1950), and in the Transvaal (Breuil and others 1948), and in ancient lacustrine beds in northern Tanganyika (Kent 1941; Leakey 1951).

A pebble-tool industry is also known from northwestern Africa, at the site of Ain Hanech, near St. Arnaud (Constantine, Algeria) (Arambourg and Balout 1952). The implements, found in fluvio-lacustrine deposits and underlying conglomerates, include spherical, polyhedral worked pebbles (*boules*), and chopping tools with a sinuous cutting edge, produced by alternate, bifacial stone percussion flaking. This industry appears to be typologically more advanced than the Kafuan, and may well fall between the Kafuan and the Oldowan known from south of the Sahara.

At the site of Kanam (Kenya), a fauna clearly Villafranchian in its composition is known from the Kafuan pebble-tool levels (Kent 1942). This assemblage is closely allied with the rich fauna from the lacustrine beds of the Omo river area in southern Abyssinia (which have not yet yielded pebble tools). A later but still Villafranchian fauna is present in deposits of the succeeding end-pluvial (Kageran-Kamasian) stage in the Lake Albert-Edward-George depression of the Western Rift valley (Wayland and others 1926); deposits of this stage likewise have not yet yielded pebble tools *in situ*. A more advanced fauna, lacking certain archaic elements, is known from the Olduvai (Leakey 1951) and Vogel river (Dietrich 1942) localities in northern Tanganyika in beds which contain Oldowan pebble tools. At Ain Hanech, the fauna is upper Villafranchian, more advanced mammals being found in the upper clay beds than in the lower conglomerate levels (Arambourg and Balout 1952).

In two instances, localities which have yielded pebble tools have also provided skeletal remains of early hominids.[2] At Kanam West, an incomplete mandible with the two right premolar teeth (and broken roots of incisors, canines, and the right first molar) has been recovered (Leakey 1935, 1936*a*). Dating of this specimen to the Kageran stage deposits has been questioned (Boswell 1935), but the balance of evidence suggests that a Kageran date is warranted. This fragment may very well represent the first remains of a "Kafuan man" ever discovered. The specimen is so broken and incomplete that it is difficult to determine positively its relationship to other hominids; the shape and pattern of the crowns of the premolars do not resemble any of the australopithecine types so far known.

In the Laetolil beds of the Vogel river, near Lake Eyasi, a hominid maxillary fragment with two premolar teeth has been found, and an isolated upper third molar was recovered some 3–6 kilometers away (Weinert 1950; Remane 1951). The dental morphology of this specimen suggests that it should be in-

cluded within the australopithecine group; it resembles most closely the type from Sterkfontein (referred to *Plesianthropus transvaalensis*) (Robinson 1953). (The specimen from the Vogel river has been referred by Weinert to *Meganthropus africanus*.) Oldowan pebble tools are reported (but not described) from the Laetolil deposits (Kent 1941); unfortunately, the relation of such implements to the hominid remains and the associated fauna found at the locality is not discussed in the literature. Nevertheless, this discovery is of particular importance since it suggests that some members of the australopithecine group may have been responsible for at least the younger stages of the pebble-tool industry. This problem deserves further field investigation at the original locality in the hope of obtaining more evidence on the association of primitive hominid remains and pebble tools in the same deposit.

It has been known for some time that the australopithecines (in part) were associated with a fauna of Villafranchian affinities, but the relative dating of the various sites has been a point of dispute. On the basis of a variety of faunal and stratigraphic evidence, it is apparent that these hominids lived during the Villafranchian stage and into the post-Villafranchian or early middle Pleistocene (Oakley 1954). The five sites in southern Africa from which australopithecine skeletal remains have been recovered can be tentatively dated as follows: (1) Kageran pluvial stage: Limeworks, Makapansgat (central Transvaal); (2) End-Kageran (interpluvial) stage: Taung (Bechuanaland) and Sterkfontein (western Transvaal); (3) Kamasian pluvial stage: Kromdraai and Swartkrans (western Transvaal). The distribution of these sites in time thus coincides with that of the pebble-tool industries; both are Villafranchian and early post-Villafranchian. There is no basis therefore to assume that "the australopithecines are Villafranchian in date and hence earlier than the makers of the pebble-culture of South Africa" (Bartholomew and Birdsell 1953). But in southern Africa, no trace of stone implements has been found in association with these early hominids at any of the five australopithecine sites. There is some evidence at the Limeworks, Makapansgat, and also at Taung, to indicate that these animals may have used ungulate humeri as clubs for killing baboons (Dart 1949), but this suggestion has not been widely accepted.

The dating of both pebble tools and early hominid remains to the Villafranchian stage in Africa raises the question of such a possible association in other parts of the Old World. To resolve this question, it is necessary to consider the place of the Pliocene-Pleistocene boundary and the date of the Villafranchian stage. Unlike most earlier periods in the geologic succession, the boundary between Pliocene and Pleistocene is not everywhere a clearly demarcated stratigraphic break. The Pleistocene epoch is characterized, however, by the onset of world-wide changes of climate (Flint 1947) which are reflected in deposits all over the world. The Pleistocene is also characterized by the initial appearance of several new mammalian genera: true horse (*Equus*), true cattle (*Leptobos*), and elephants (*Archidiskodon*) of the *meridionalis-planifrons* group (Haug 1911). Application of these two criteria, one geological, the other paleontological, makes possible a clear delineation of Pliocene from

later Pleistocene deposits. Intercontinental correlations are admittedly still uncertain, but it is nonetheless useful to compare developments in different areas on the basis of this definition of the Pleistocene.

A fourfold glacial sequence has been firmly established in the Alpine region but the relation of European continental and marine deposits to this sequence has been a major problem. For this reason, some workers (cf. Zeuner 1952) have regarded the continental Villafranchian beds and their marine equivalent, the Calabrian, as of late Pliocene age. A thorough examination of the evidence indicates, however, that this position is untenable. The classic Villafranchian localities in southern France and in Italy indicate that deposits of the Villafranchian stage are separated unconformably from earlier Plaisancian-Astian sediments laid down in an extensive Pliocene sea (Movius 1949). In southern France, Villafranchian mammals are known from continental loess deposits of undoubted glacial age which establish unequivocally a correlation with the Günz glacial stage in the Alps (Viret 1948). Marine deposits of the Calabrian sea contain a molluscan fauna with northern or boreal species indicative of the onset of colder conditions subsequent to the subtropical climate of the late Pliocene (Migliorini 1950; Movius 1949). On the basis of the most recent evidence, the Pleistocene age of the Villafranchian and Calabrian stages is established beyond cavil; this dating received international acceptance at the 18th International Geological Congress held in London in 1948 (King and Oakley 1949). The Calabrian must therefore be correlated with the first Alpine glaciation; the succeeding Sicilian stage of high sea level, after the regression of the Calabrian Sea, must be synchronous with the first continental interglacial stage (Movius 1949).

No pebble tools are known in deposits of the Calabrian or Villafranchian stages anywhere in Europe. The newer series of East Anglian Crags are deposits of basal Pleistocene age on the basis of their molluscan fauna (Boswell 1936, 1952). The supposed flint industries from the underlying sub-Crag deposits (Moir 1927) are the product of natural agencies rather than the result of human manufacture (Barnes 1938); the same applies to the supposed artifacts referred to the "Cromerian" from the Cromer Forest Bed (of first interglacial or succeeding interstadial age). The "long chronology" for the Somme terraces which dates the Abbevillean to the first interglacial stage (Breuil and Koslowski 1931–1932, 1934; Breuil 1939) is questionable and this industry is apparently not present in Europe until the second glacial stage (Mindel in the Alps, Elster in northern Europe). The age of this industry has been established in northwestern Africa (site of Sidi Abderrahman, near Casablanca, Morocco) where Clacto-Abbevillean ("Rahmanian") artifacts occur in interstratified deposits between terraces of the Sicilian and Milazzian stages (Neuville and Ruhlmann 1941; Ruhlmann 1945). The Clactonian is certainly second interglacial in age in the Thames river valley, and probably also second glacial; it is similar in many respects to the Oldowan of central and southern Africa and the chopper/chopping-tool complex of southern and eastern Asia (cf. Warren 1951).

In Asia, erosion surfaces and unconformities separate Pliocene formations from later deposits of the Villafranchian stage in northern China and northern India; in Burma, and in Java, the Villafranchian stage is established on the basis of faunal evidence (Movius 1944). A fourfold glacial sequence established in the Himalayas affords a basis for correlation of deposits in adjacent lowland areas (De Terra and Paterson 1939). Correlation of insular regions which were once part of the Sunda Shelf is made possible through fairly detailed knowledge of the continental and insular Asian faunas of the Pliocene and Pleistocene. There is no evidence in southern and eastern Asia of hominid occupation prior to the early middle Pleistocene (Movius 1944, 1948). At that time, the first stages of the chopper/chopping-tool/hand-adze complex are present in upper Burma (Early Anyathian) and probably northern China (Locality 13 at Choukoutien). The "Punjab Flake Industry" ("Pre-Soan") is found during the Himalayan Second Glacial stage but its affinities to this complex are not clearly defined; a northern India form of the complex is present in the succeeding interglacial stage (Soan).

There is a fundamental similarity between the African pebble tools and the early stages of the chopper/chopping-tool/hand-adze complex of southern and eastern Asia. The African pebble tools appear, however, at an earlier date in the Pleistocene (Table 1) suggesting that Africa was most likely the center of origin. Furthermore, the detailed morphological resemblance between the

TABLE 1

OUTLINE OF THE VILLAFRANCHIAN STAGE IN THE OLD WORLD (SHADED) AND THE OCCURRENCE OF THE EARLIEST STONE INDUSTRIES AND FOSSIL HOMINIDS

| | AFRICA | | EUROPE | | ASIA | |
|---|---|---|---|---|---|---|
| | CENTRAL-EASTERN | SOUTHERN | BRITISH ISLES | FRANCE-ITALY | MAINLAND | SUNDA SHELF |
| KAMASIAN PLUVIAL | OLDUVAI(2) *CHELLEAN* | OLDER GRAVELS OF VAAL RIVER *OLDOWAN* | NORTH SEA DRIFT *ABBEVILLEAN* | SOMME RIVER *ABBEVILLEAN* | KASHMIR GLACIAL 2 / INDIA: *EARLY ANYATHIAN* | |
| | OLDUVAI(1) ↓ *OLDOWAN* ↓ LAETOLIL BEDS *Meganthropus* | SWARTKRANS-BRECCIA *Paranthropus* KROMDRAAI-BRECCIA *Paranthropus* | MINDEL IN ALPS: CROMER FOREST BED; WEYBOURNE CRAG | | IRRAWADDY LATERITIC GRAVEL; LOCALITY 13 AT CHOUKOUTIEN *CHOPPING TOOL* | TRINIL FAUNA *Pithecanthropus*; DJETIS FAUNA *Meganthropus* |
| END-PLUVIAL | MIDDLE KAISO SERIES | STERKFONTEIN BRECCIA *Plesianthropus*; TAUNG BRECCIA *Australopithecus* | INTERGLACIAL: CHILLESFORD CRAG; NORWICH CRAG | SICILIAN RAISED BEACH(180-100m.) | NORTHERN INTERGLACIAL / INDIA: UPPER IRRAWADDIAN | KALI GLAGAH |
| KAGERAN PLUVIAL | HIGH TERRACES OF KAGERA RIVER ↓ *KAFUAN* ↓ KAMAM *H. Kanamensis* | BASAL OLDER GRAVELS OF VAAL RIVER *KAFUAN*; LIMEWORKS BRECCIA *Australopithecus* | GUNZ IN ALPS: NEWER RED CRAG | CALABRIAN SEA | KASHMIR GLACIAL 1 / INDIA: UPPER SIWALIKS BEDS IN BURMA | TJI DJOLANG |
| PLIOCENE-PLEISTOCENE BOUNDARY | | | | | | |

earliest hominid known from southeast Asia (referred to *Meganthropus palaeojavanicus*—from Sangiran, Java) and some later members of the australopithecine group (Robinson 1953) suggests derivation of the Asiatic hominids from some portion of the australopithecine radiation. Both the Djetis fauna, with which this Javan hominid is associated, and the somewhat more advanced Trinil fauna with which *Pithecanthropus* is associated, are of early middle Pleistocene, post-Villafranchian age (Hooijer 1951, 1952; Hooijer and Colbert 1951).

The view is widespread that the australopithecines of Africa lived too late to be ancestral to "true men" and also that "true men" were already living at the same time as the australopithecines. It is apparent, however, that australopithecine types were present in the basal Pleistocene (Villafranchian) of Africa, before any "true men" are recorded in the fossil record, *as well as later* in the early middle Pleistocene. It has been suggested that the several australopithecine varieties are of like geologic age (King 1951) but, as Robinson (1952) and Oakley (1954) point out, there is little evidence in favor of this conclusion; there is no evidence to suggest an upper Pleistocene age for any of these forms. In southern Africa, there is no evidence as yet to indicate that these particular australopithecines were tool-makers. The presence of an australopithecine in the Laetolil beds of the Vogel river, deposits which contain Oldowan pebble tools, is suggestive that *some* members of the australopithecine group may have been responsible for the pebble-tool assemblages. The priority of these hominids in Africa, and the subsequent appearance in Europe and in Asia of industries closely related to the Pre-Chelles-Acheul complex of Africa, is highly suggestive of an original African center of origin.

Much has been said in the past about the Asiatic center of hominid origins. At the present time, there is little evidence to suggest that central Asia was this center as was once believed. Abundant evidence of Pliocene and Pleistocene mammalian faunas has been collected in the sub-Himalayan region but no hominid remains like those from the Villafranchian stage south of the Sahara have yet come to light; admittedly, such discoveries may possibly be made in the future. The writer believes that there is now much evidence in favor of tropical Africa as this center. It is in that region where the earliest examples of tool-making occur, and it *may* well be the region where characteristic hominid bipedalism was first attained.

## NOTES

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[2] The term hominid is here used to include all members of the family *Hominidae*, a taxonomic category defined on the basis of bipedal locomotion. The term includes the australopithecine group which is generally referred to a separate subfamily (*Australopithecinae*) of the family *Hominidae*.

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