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(Net)working a Stone into a Tool. How Technologies of Serial Visualization, Arrangement, and Narration Stabilized Eoliths as Archeological Objects

Summary

This paper deals with issues surrounding so-called eoliths in the nineteenth and early twentieth century: Were these very crudely chipped stones from European Tertiary deposits really human-made? The focus is on the visual, spatial, and narrative arguments used by some of the eoliths-proponents. One powerful strategy consisted in integrating the supposed tools into existing geological, archeological, and paleoanthropological series, relying on established scientific knowledge and the wider cultural significance of the serial. However, the flints first had to be translated in cascades of inscriptions from actual stones in situ into drawings and series of drawings in publications to eventually gain a high level of abstraction as elements in formalized tables of juxtaposed series. My discussion of the eoliths focuses on these aspects in the production of knowledge in transit between communities, spaces, and media.

Keywords: History of archeology; history of paleoanthropology; knowledge circulation; eoliths; human evolution; visualization; serialization.

Dieser Beitrag setzt sich mit den historischen Kontroversen um die sogenannten Eolithen auseinander: Waren diese sehr rudimentär abgeschlagenen Steine aus europäischen Tertiärschichten tatsächlich das Resultat menschlicher Arbeit? Der Fokus ist auf die narrativen, visuellen und räumlichen Argumente einiger Eolithen-Verfechter gerichtet. Eine wirkmächtige Strategie war die Integration der vermeintlichen Werkzeuge in geologische, archäologische und paläoanthropologische Serien, um damit an etabliertes Wissen und an die kulturelle Bedeutung des Seriellen anzuschließen. Zuvor mussten die Feuersteine jedoch in Transkriptionskaskaden von Objekten *in situ* in Zeichnungen und serielle Abbildungen in Publikationen übersetzt werden, um schließlich den Abstraktionsgrad von Elementen in hoch formalisierten Tabellen einander gegenübergestellter Serien zu erreichen. In meiner Diskussion nehme ich diese Aspekte der Wissensgenerierung im Transit zwischen unterschiedlichen Gemeinschaften, Räumen und Medien ins Visier.

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Keywords: Geschichte der Archäologie; Geschichte der Paläoanthropologie; Wissenszirkulation; Eolithen; Evolution des Menschen; Visualisierung; Serialisierung.

I am grateful to the American Museum of Natural History for giving me access to the Osborn Papers in the Special Collections Library, and to the incredibly helpful staff of the archive. I would also like to thank the editors of the *Notes and Records of the Royal Society of London* for giving me permission to base this article on Sommer 2010. Special thanks are due to Gisela Eberhardt and Fabian Link for the organization of a wonderful conference in 2010 and the editing of the volume. The research for this contribution has been carried out within the project 'History Within: The Phylogenetic Memory of Bones, Organisms, and Molecules' that was financed by the Swiss National Science Foundation.

In 1921, the paleontologist and president of the American Museum of Natural History (AMNH), Henry Fairfield Osborn, ordered a series of supposed stone tools by letter from the English amateur archeologist James Reid Moir. Reid Moir had been digging in East Anglia and brought to light what he took to be human-made tools from Tertiary deposits. The human workmanship of such stones was very controversial, but by the time Osborn ordered the series, the crudely chipped flints, to which I will generally refer as eoliths, were at the height of their acceptance in the international scientific communities as human-made tools. Eoliths extended the antiquity of hominids in Europe from the Pleistocene into the Tertiary; they expanded the archeological record from the Paleolithic into the Eolithic. When he ordered a series, Osborn was in the last steps of preparing a new exhibition hall on human evolutionary history. The AMNH should not fall short of its British counterpart, the British Museum of Natural History, where the keeper of paleontology, Arthur Smith Woodward, had included eoliths in the exhibit as early as 1909.[1]

Ludwik Fleck has described the communication of scientific knowledge as integral to the formation of a scientific fact in his canonical *Entwicklung und Entstehung einer wissenschaftlichen Tatsache* of 1935.[2] The communication from specialists to non-specialist audiences goes along with the translation of the cautious formulation of a phenomenon in a scientific journal article into the objectifying and generalizing language of the textbook and popular text that harden the finding into a fact. Fleck regarded this process rather as a cycle than as a one-way transfer, because popular science forms the specific

1 American Museum of Natural History, Special Collections Library, Henry Fairfield Osborn Papers MSS O835 (hereafter AMNH, Osborn Papers), correspondence with J. Reid Moir, Box 15, Folders 15–17.

2 First translated into English in 1979 as *The Genesis and Development of a Scientific Fact,* eds.: T.J. Trenn and R.K. Merton, Chicago: University of Chicago Press.

public opinion and the worldview that influence the specialist as part of the wider culture. Fleck therefore already reinterpreted the process of popularization, which has since become a central concern for historians of science.[3] Except as an actor category, the term *popularization* has been largely abandoned in its nineteenth-century meaning of a one-way communication of objective scientific knowledge from its hermetically closed context of discovery to a diffuse mass of people who are in need of education. Popularization in this sense was understood as an instrument of social progress, of secularization and rationalization. While we still see in the communication of scientific methods and contents a factor of socio-cultural change, our understanding of the practices, sites, protagonists, media, and forms of representation that partake in the generation, communication, and adaptation of knowledge about the natural world has become considerably more complex and diverse.[4]

In his keynote lecture for the Three-Societies Meeting in Halifax of 2004,[5] James Secord has suggested to unite the diverse approaches in the history of science and science studies under the label "knowledge in transit".[6] The label not only suggests a symmetrical treatment of scientific knowledge production with popular and indigenous knowledge; it, too, goes along with an understanding of all science as a form of communication. We may object to this move by pointing to the fact that science in action is also about the lack of communication, about black-boxing processes and the materialization of theories and concepts in technological setups and natural phenomena as brought to light by scholars in the tradition of historical epistemology.[7] The communication of knowledge depends on the representation and re-representation of phenomena prior to circulation, with Latourian cascades of inscriptions that are as much processes of translation as the circulation of objects of knowledge between diverse geographical, social, and cultural spheres.[8] The lesson from a knowledge-in-transit approach remains, however, that we need to take account of the non-Western, the non-elite, and the non-male. The history of science since the cultural turn has expanded its sources to include the subaltern, the vernacular, and the market- and media-oriented products of popular culture as much as the so-called high culture of literature and the arts. We turn to the places and media where scientific practices, forms of representation, values, and ideas are communicated, negotiated, transformed, and rejected.

The AMNH is one such place, and my research into its history has shown how the collection of data, their interpretation, and the representations of the findings in expert and popular contexts all have to be seen as intimately linked; knowledge was indeed in transit: in movement, translation, and transition between people, spaces, and

3 Fleck 1936; also Fleck 1935.

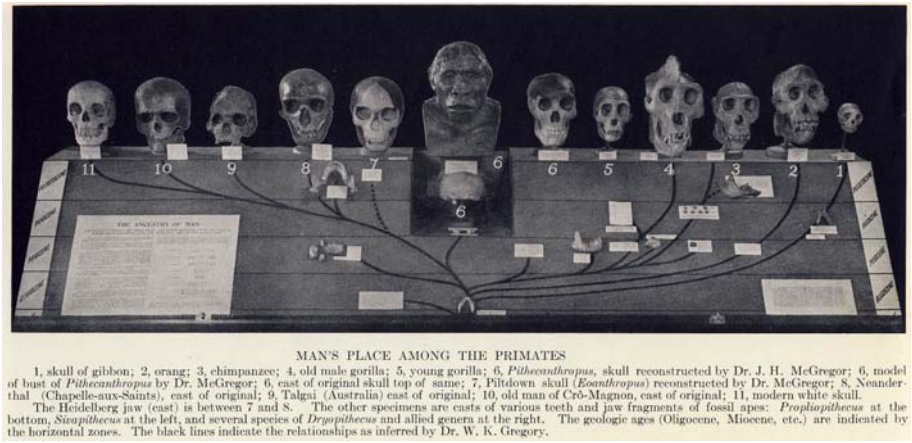
4 For a classical treatment, see Cooter and Pumfrey 1994.

5 The British Society for the History of Science, the Canadian Society for the History and Philosophy of Science, and the History of Science Society.

6 Secord 2004.

7 Rheinberger 1997.

8 Latour 1987, ch. 6.



MAN'S PLACE AMONG THE PRIMATES

1, skull of gibbon; 2, orang; 3, chimpanzee; 4, old male gorilla; 5, young gorilla; 6, *Pithecanthropus*, skull reconstructed by Dr. J. H. McGregor; 6, model of bust of *Pithecanthropus* by Dr. McGregor; 6, cast of original skull top of same; 7, Piltdown skull (*Eoanthropus*) reconstructed by Dr. McGregor; 8, Neanderthal (Chapelle-aux-Saints), cast of original; 9, Talgai (Australia) cast of original; 10, old man of Crô-Magnon, cast of original; 11, modern white skull.
The Heidelberg jaw (cast) is between 7 and 8. The other specimens are casts of various teeth and jaw fragments of fossil apes: *Propliopithecus* at the bottom, *Sivapithecus* at the left, and several species of *Dryopithecus* and allied genera at the right. The geologic ages (Oligocene, Miocene, etc.) are indicated by the horizontal zones. The black lines indicate the relationships as inferred by Dr. W. K. Gregory.

Fig. 1 Showcase in the Hall of the Age of Man at the American Museum of Natural History in the 1920s.

media. At Osborn's time, the AMNH was a site where humans, discourses, and objects from various social, cultural, and geographical contexts met in the production and consumption of knowledge about the natural world, and from where hybrid objects were internationally distributed. Among these were eoliths: They traveled as stones, as casts, as photographic representations and drawings, and re-represented in diagrams, tables, and narratives. As a result, when the Hall of the Age of Man finally opened to New Yorkers and visitors to the city in 1924, they did not encounter the contested history of the eoliths, or carefully phrased statements and hypotheses. They encountered rock-hard facts. They saw artifacts left behind by European hominids of the Tertiary. They also saw casts of fossil bones, busts of extinct hominids, and murals showing entire life-scenes from evolutionary history that were expertly set in communication with each other to provide a panoramic view and the necessary spectacle to engage the visitor attuned to the visual culture of the great exhibitions and circuses.[9]

Fig. 1 represents one of the pieces of the exhibit – if a rather drily didactic one. From this showcase, the visitor may have learned about man's place among the primates. The genealogy of the primates is a branching structure, and the line leading from the last common ancestor of all lines, *Propliopithecus* – here signified by a jaw –, to living humans is empty. There are no fossils to document our history and evolution from Oligocene times. But the message is ambiguous, because the horizontal series of skulls might be read as a descending ladder from modern white man (No. 11 in the legend), via Cro-Magnon, Neanderthal, Piltdown, *Pithecanthropus* (the bust in the middle – today called *Homo erectus*), gorilla, chimpanzee, and orangutan, down to the gibbon.

9 See Halttunen 2008.

In a special issue of the journal *History of Science*, Nick Hopwood, Simon Schaffer, and James Secord have brought together articles on the role of seriality in the long nineteenth century.[10] Series became important in periodical publication, production processes, and economic management. From their application in mathematics, the words *series*, *série*, and *Serie* entered philosophical and social programs, historical reconstructions, and the sciences of statistics, geology, paleontology, chemistry, botany, and anthropology. While the social, economic, and cultural was increasingly serially organized (such as in literary publication, workflows, travel experience, photography, and cinema), the natural, too, seemed to be serially structured. The question of the existence of progressive forces and developments in heaven and on earth troubled the sciences. In order to capture such spatio-temporal phenomena, researchers innovated and adapted serial iconographies: In geology, new visual techniques allowed to get beyond the mapping of the superficial distribution of minerals to seemingly render transparent vertical stratification; embryologists produced serial images of developmental stages; even electromagnetic phenomena were communicated in series of images documenting serial experimentation. However, as the papers collected in *History of Science* render evident, iconic and narrative seriality was not simply suggested by the scientific practice or the natural phenomena under investigation. Rather, processes of translation, manipulation, and abstraction were involved in the production of iconic and textual – or mobile – series. This suggests that the power of series was such that scientists worked hard to exploit their appeal. They developed serial visual rhetoric for making spatial and temporal successions compelling, not only in communication between experts but also to larger publics. Serialized forms of imagery and publication, series of museum displays, and serial exhibition of objects drew on and encouraged the serialization of everyday experience.[11]

But series were never uncontested. This is inscribed in the AMNH showcase. The contradiction between the two messages of, on the one hand, a bushy family tree and, on the other, a scala naturae arrangement of the horizontal skull series captures something significant about the time. Around the turn to the twentieth century, the paleoanthropological and archeological communities mostly abandoned the linear view of evolution held by their predecessors; partly due to the discovery of many more fossils, they adopted branching models of human descent. This did not mean, however, that they also abandoned all notions of progressive development.[12] Correspondingly, Constance Areson Clark has convincingly shown that a public trained to literacy in the visual language of progress – in which the series played a crucial role – may have read images as conveying linear progressive development even where such was not consciously communicated.[13] Furthermore, as illustrated by the primate tree, the visual rhetoric of the

10 Hopwood, Schaffer, and Secord 2010.
11 Hopwood, Schaffer, and Secord 2010, 251–285.
12 Sommer 2007, Part II.
13 Areson Clark 2001.

series was not abandoned when the ancestral line of living humans was cleared from fossil remains, which were relegated to sidelines; rather, we will see how series were made to work differently, a process that rendered them dangerously ambiguous. The same points may be made with regard to the verbal representation of human evolutionary history that strongly relied on literary genres and cultural tropes that facilitated the rendering of evolutionary history as a series of progressive stages. However, narratives were much more contextual and idiosyncratic than Misia Landau has suggested with her reduction of evolutionary scenarios to an arrangement of a fixed set of elements in a single narrative structure.[14]

In general, anthropologists and archeologists in the early decades of the twentieth century continued to use many of the tools of the trade established in the nineteenth century. They drew evolutionist analogies between stages of biological, cultural, and mental evolution, and between so-called primitive or savage and prehistoric peoples and cultures. It is only through this continuity that artifacts of a certain prehistoric culture could still stand in for a fossil human type. The early split between the anthropoid and hominid lines, visualized in the primate tree of Fig. 1, was justified in the exhibition guidebook by supposedly human-made tools from the European Miocene – by eoliths. It was the tool-making ability of Dawn Man – as the hypothetical human ancestor was called – that put at a distance the cultureless ape. In other words, different series – the geological, archeological, and paleoanthropological series – could mutually reinforce each other and fill each other's gaps. In order for series to do this powerful work, however, eoliths first had to be translated in cascades of inscriptions from actual stones in situ into elements in highly formalized tables of juxtaposed series. Series circulated through the international networks of archeologists and anthropologists in several degrees of abstraction from the typological tool series to the column of archeological cultures in context. In agreement with the analytical turns towards the visual, the narrative, the spatial, and the performative, my discussion of the eoliths therefore focuses on these aspects in the production of knowledge in transit between communities, spaces, and media.[15] The series is key here, because serialization is a technology of visual narration that performs compelling arguments for spatio-temporal processes.

In this way, in following the process of (net)working stones into tools, I hope to shed new light on the history of eoliths as an example of how scientific knowledge is produced, circulated, and in transformed, but also stabilized, in the interaction between different scientific communities. Previous engagements with the discourses around eoliths have aimed at the unraveling of a forgery,[16] the explanation of the resolution of a controversy within the history of Paleolithic chronology and classification,[17]

14 Landau 1991.
15 Bachmann-Medick 2009.
16 Spencer 1988.
17 O'Connor 2003; O'Connor 2005; O'Connor 2007, ch. 5.

or at an ontology of current views, even the understanding on the basis of cognitive science, specifically cultural cognition,[18] with the processes of visualization, narrativization, and spatialization playing a marginal role at best. From my different perspective, I begin with the work of Gabriel de Mortillet to illustrate how the eoliths profited from the persuasive power of the serial in Western cultures. I then turn to Great Britain to focus on Reid Moir's detailed work of translating eoliths into stones marked by human intention and integrating them into particular typological, archeological, geological, and production series. At the end, I return to the American scene and ask what kind of work the eoliths and their serial integration performed in the novel paradigm of a branching hominid phylogeny in which no known fossils were considered ancestral to modern humans.

1 Gabriel de Mortillet: The first eoliths and the performance of progress in France

If the year 1859 brought a consensus with regard to the coexistence of humans with the extinct Pleistocene fauna, the rejection of a conservative Biblical timeframe for the age of humankind opened up vast spaces of time for investigation. How far back could human history be traced? In France, the acceptance of human antiquity was followed by a controversy about eoliths, supposedly human-made flint tools from Tertiary deposits. Gabriel de Mortillet (1821–1898) of the École d'Anthropologie in Paris was the most prominent supporter of the dawn tools and the creator of the term *Eolithique*, the Dawn Stone Age, which for him referred to the Tertiary period. But de Mortillet is most remembered today for his classification of the Paleolithic industries as a progressive series from the Chellean or Acheulean, to the Mousterian, Solutrean, and finally to the Magdalenian. By the time de Mortillet accepted the supposedly Eolithic stone tool cultures, his archeological system was already in place.

That the archeological series was part of a larger scheme becomes evident in the prehistoric section of the Universal Exhibition in Paris of 1867, for which de Mortillet had been responsible. The series of world fairs organized in the Western metropolises of the nineteenth century itself epitomized stages in the progress of industry and empire. In the case of the history of industry *(l'histoire du travail)* at the Parisian Universal Exhibition, the exhibits occupied the first concentric ring around the central garden in the oval exhibition building. Each nation filled a section of the ring, with the most important nations appearing first and being allotted larger sections.[19] Within the territory of each nation,

18 Ellen and Muthana 2010.

19 See image at http://commons.wikimedia.org/wiki/File:Exposition_universelle_de_1867.png?uselang=de (visited on 07/07/2015).

the halls were ordered chronologically, from prehistory to the present. From the main entrance, the visitor could either enter Great Britain or France, but de Mortillet used the guide he wrote for the prehistoric exhibits to suggest turning left and beginning the tour with France (moving clockwise).[20] Here, France's technological progress unfolded before the visitor's eyes from the hall *La Gaule avant l'emploi des métaux* to those celebrating recent innovations. Within the prehistoric part of this progress, the halls represented the Paleolithic, Neolithic, dolmen, lake-dwelling, Celtic, Gaul, and Gallo-Roman periods. Within the Stone Age hall, artifacts were again arranged chronologically on the basis of archeological sites.

Thus, de Mortillet led the visitors on a tour through the inner exhibition circle during which the prehistoric epochs were repeated in national sections, pointing to the parallel development in different geographical regions. He also directed the guide readers towards more current technologies and customs found in the exhibits of the civilized nations that indicated continuity in form or use beyond prehistory. At the same time, he drew attention to the galleries on the colonies of France and of other European nations. Here, he referred the visitors to the similarities with objects from Western prehistory – illustrating the possibility that the universal technological development may take place at different times for different peoples. In other words, de Mortillet used his guide narrative, the architecture of the exhibition, and the serial arrangement of the exhibits in space to enact for the visitors what he conceived of as the great laws of human evolution. They should witness the law of universal human progress, the law of similar developments in all human races, and the great antiquity of humankind. In doing so, de Mortillet emphasized that *l'histoire du travail* illustrated by the progressive series in material cultures signified a respective mental and anatomical progress.[21]

In his guide through the 1867 exhibition, de Mortillet assured the reader that the French committee had taken particular care to exclude from the Paleolithic exhibits any object the origin or authenticity of which was doubtful. There was therefore no trace of Tertiary Man, such as had been brought forward by Jules Desnoyers in 1863. But after the Universal Exhibition, the reports grew, and some of the Tertiary stones claimed to have been shaped by an intelligent toolmaker were accepted by French prehistorians of great renown. These de Mortillet included in *Le Préhistorique: Antiquité de l'homme* of 1883 as positive proof of Tertiary Man in Europe. He explained that "[f]ollowing an excellent method applied in geology, – one is not to forget that paleoethnology is directly derived from geology, – I have given each period the name of a very typical site […]".[22] Thus, the geological series literally became the series of cultural stages. De Mortillet therefore

20 Mortillet 1867.

21 On the exhibit see also Schlanger 2006.

22 "Suivant une excellente méthode adoptée en géologie, – il ne faut pas oublier que la paléoethnologie découle directement de la géologie, – j'ai donné à chaque époque le nom d'une localité bien typique […]." Mortillet 1883, 29, my translation in main text.

described not only the human industries and their distribution from the *Eolithique* to the *Neolithique*, but also gave an account of the geology, fauna, flora, and of possible fossil human remains, for each epoch. In other words, he verbally painted the grand story of human evolution as the geological, paleontological, paleoanthropological, and archeological series in parallel progression. This method pointed to a void in the paleoanthropological series vis-à-vis the Eolithic cultures, because de Mortillet rejected the human remains that had been reported for Tertiary deposits. However, where there were tools, there must have been a shaper. De Mortillet therefore invented *Anthropopithecus*, a missing link between the highest anthropoid ape and the lowest savage that had fashioned the eoliths from France and Spain and that had evolved into the Neanderthals and eventually the Cro-Magnons.

As Michael Hammond has described in a by now classical paper, de Mortillet's linear view of human evolution was strongly interwoven with his politics.[23] He extrapolated the prehistoric progressive series of biological, cultural, and mental development to an inevitable historical succession from the reign of the nobility, to the reign of the bourgeoisie, and finally to the reign of the socialists. In other words, the eoliths fitted well into the pattern of lawful series found to prevail in geology, anthropology, archeology, as well as history that were internationally commemorated in such events as the Universal Exhibition.

2 James Reid Moir: The production of series and the serial production of Eoliths

The British, too, had had their reports of eoliths, and the controversy became most heated around the work of the Ipswich amateur archeologist James Reid Moir and his allies. Those who did not accept the human workmanship of the eoliths generally brought forward the following set of objections that denied the integration of eoliths into meaningful series: Paleontologically, an Oligocene and Eocene hominid appeared to be an impossibility due to the state of evolution of the entire mammalian branch at this early epoch. Geologically, forms identical to the so-called eoliths could be picked up from many a modern beach or gravel. Paleoanthropologically, those eoliths that were taken from older strata were not part of a human settlement or shelter, but integral to geological formations, themselves often thrown violently into place. Technically, sea waves, river torrents, and ice sheets, sudden changes of temperature, pressure or compression through landslides, folding, etc. were observed to produce eoliths naturally. Moreover, eoliths could be reproduced mechanically and were even among the spontaneous products of a cement-mixing machine.

23 Hammond 1980.

The eoliths-proponents answered the critique on the one hand by focusing on human intentionality. The question of human design had already been foremost for de Mortillet, who treated the visible traces of human intentional action on a stone in some detail. There can certainly be made an argument for the evidential strengths of single tool representations. The simplicity, regularity, and repetitiveness in design that were associated with the traces of human intention on stone were visually formalized for paleoliths, and relied on by the eoliths-proponents in their visual arguments for artificiality. There exists considerable scholarship on visualizations of entire prehistoric life scenes with regard to their persuasiveness for certain theoretical stances, their conservatism, and their gender and race stereotypes. There has been far less analysis of the history of lithic visualization. The development of a universal language in lithic drawing, the pervasiveness and advantages of drawing over photography, and the role of the concept-content of images in the history of archeology still present promising research questions.[24]

But even more strongly than the particularity of an individual tool, a series could help a stone type's establishment as human artifact. This is a strategy that Reid Moir made wide use of. Of particular importance in Reid Moir's textual and visual arguments was a specific type of eolith: the so-called rostro-carinate. It was an invention of Ray Lankester, the former Oxford zoologist and director of the British Museum of Natural History.[25] During the initial decades of the twentieth century, Reid Moir and Lankester discovered and described eoliths from below the Upper Pliocene marine deposit referred to as Crag, which covers a considerable part of East Anglia.

The rostro-carinate was so central for the integration of the Tertiary tools into the existing classification of sites and technologies because it could function as a missing link. In order to refute the general belief that the Sub-Crag eoliths had no cultural relationship to the paleoliths, Reid Moir experimentally produced a typological series from the earliest eoliths to the earliest paleoliths. The intermediate stages of the process of fashioning paleoliths from eoliths he identified with actual stones ('tools') found at different sites that he arranged in an analogous series. In the sense developed by Steven Shapin and Simon Schaffer, this experimental and evidential re-enactment of tool-type evolution could be virtually witnessed by means of visual representation and distribution in renowned scientific journals.[26]

Fig. 2 is a schematic representation of a rostro-carinate that Reid Moir copied from Lankester which emphasizes its characteristic carina (keel) and beak. Fig. 3 shows how it is produced: A flake is detached from a potato-shaped flint to produce the ventral plane, blows are then applied at a particular angle to both sides of the surface to form the keel, finally the ventral side is flaked to achieve a concave form. Fig. 4 is a representation of the

24 Lopes 2009.
25 Lankester 1912.
26 Shapin and Schaffer 1985.

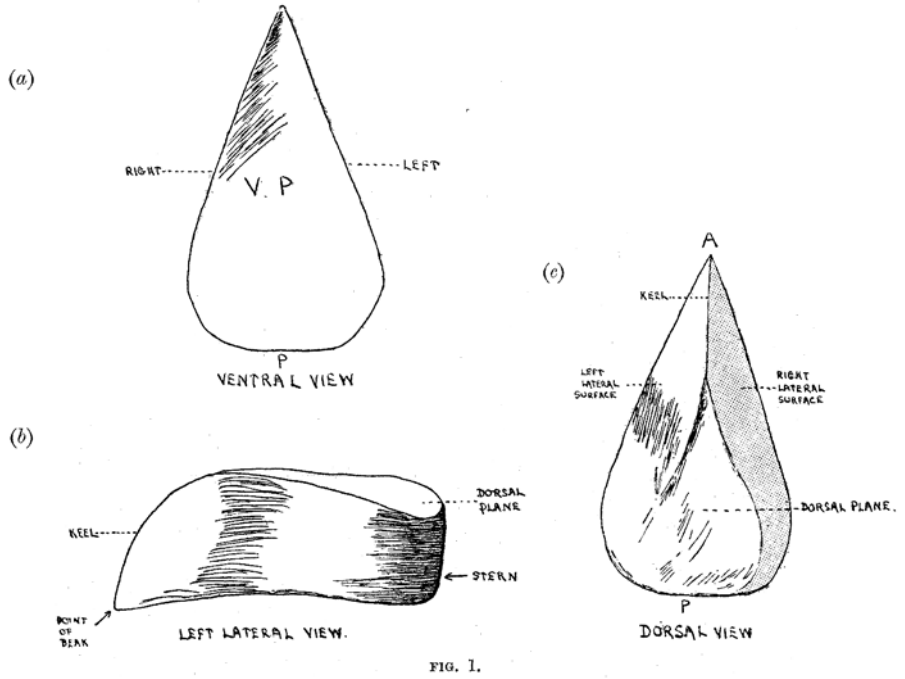


Fig. 2 ‚Rostro-carinate' eolith according to Reid Moir and Lankester.

typological evolution from the earliest Eolithic types into the rostro-carinate illustrated on the basis of actual 'tools' – it shows the same general steps as the experimental production, that is the flaking of the carina and the beak. Reid Moir wanted to demonstrate that the rostro-carinate type existed at different stages of refinement that characterized different Eolithic cultures. Moreover, he believed that the finished rostro-carinate could be flaked into a Paleolithic tool type to provide an entire series. Again Reid Moir came up with a series of actual stones that matched his experimentally produced stages. Figures 5 to 14 represent such a series of stones from various sites that showed bilateral flaking to form a beak, flaking of the stern, flaking of the ventral and dorsal planes, and then the gradual extension of the keel until it met the stern. The next steps were represented by Paleolithic tools called Chelles, in which Reid Moir still recognized a keel.[27]

27 Reid Moir 1916.

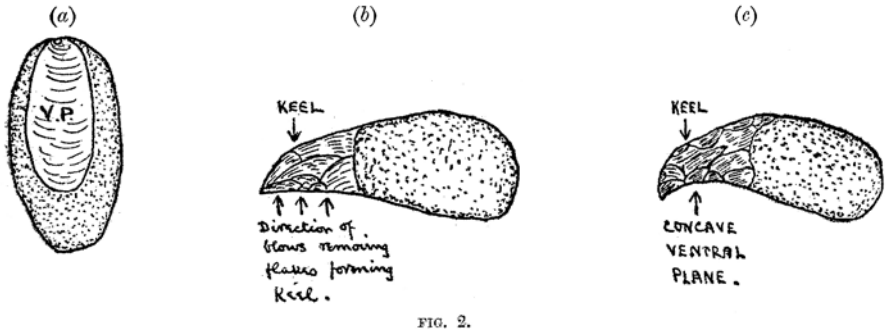


Fig. 3 Experimental production of rostro-carinate.

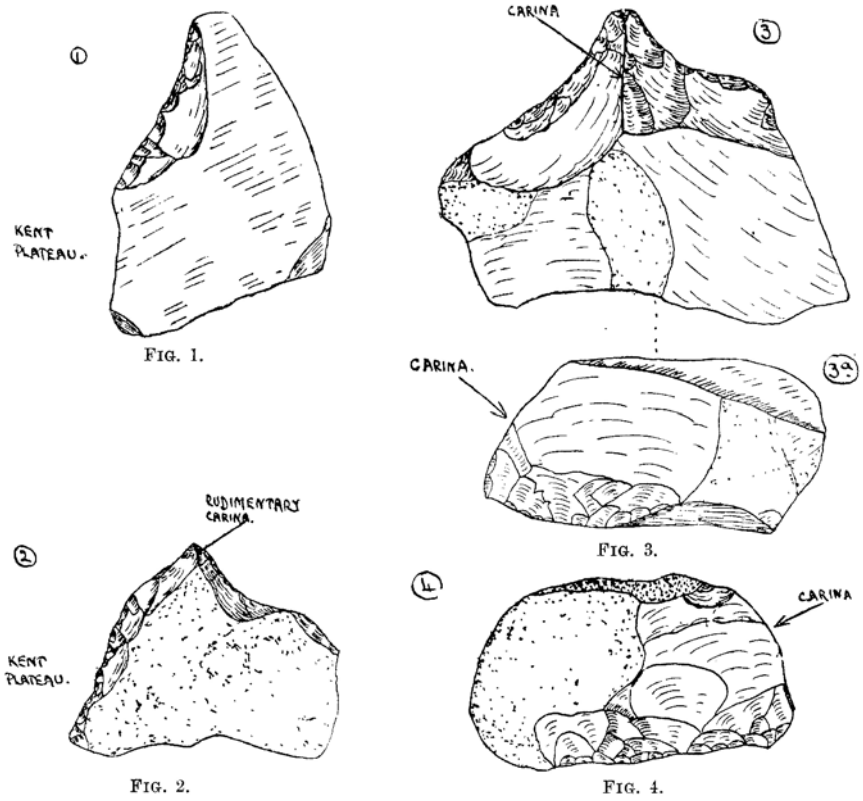


Fig. 4 Alleged precursors of the rostro-carinate form.

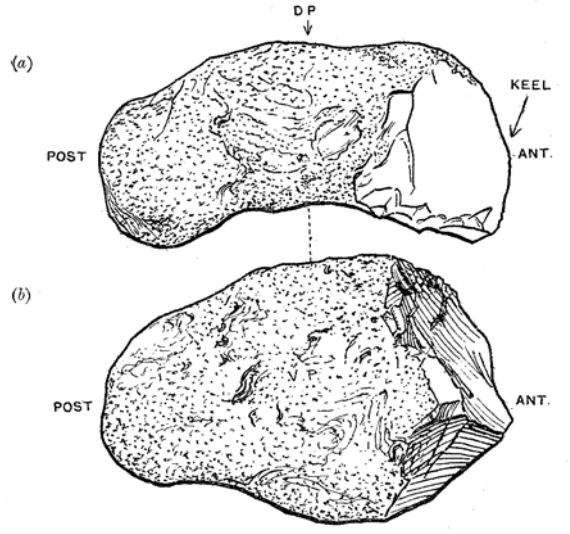


FIG. 3.—VIEW OF (*a*) RIGHT LATERAL SURFACE ; (*b*) VENTRAL PLANK OF MOST PRIMITIVE TYPE OF ROSTRO-CARINATE IMPLEMENT. ($\frac{2}{3}$ NATURAL.)

Fig. 5 After Reid Moir.

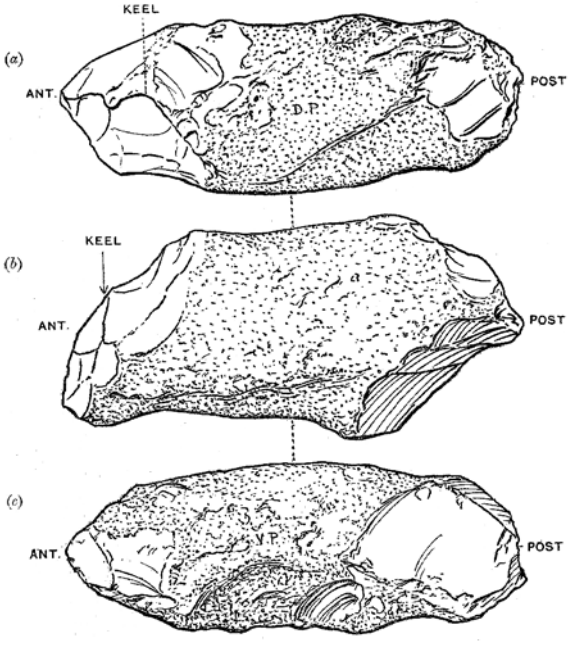


FIG. 4.—VIEW OF (*a*) DORSAL SURFACE ; (*b*) LEFT LATERAL SURFACE OF ROSTRO-CARINATE IMPLEMENT SHOWING SECOND STAGE OF EVOLUTION ; (*c*) VENTRAL SURFACE. ($\frac{2}{3}$ NATURAL.)

Fig. 6 After Reid Moir.

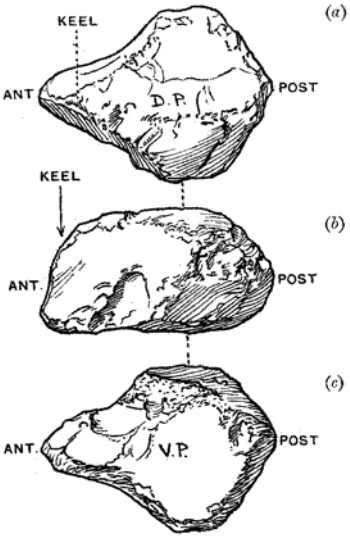


FIG. 5.—VIEW OF (*a*) DORSAL SURFACE ; (*b*) LEFT LATERAL SURFACE OF ROSTRO-CARINATE IMPLEMENT SHOWING THIRD STAGE OF EVOLUTION ; (*c*) VENTRAL SURFACE. (⅔ NATURAL.)

Fig. 7 After Reid Moir.

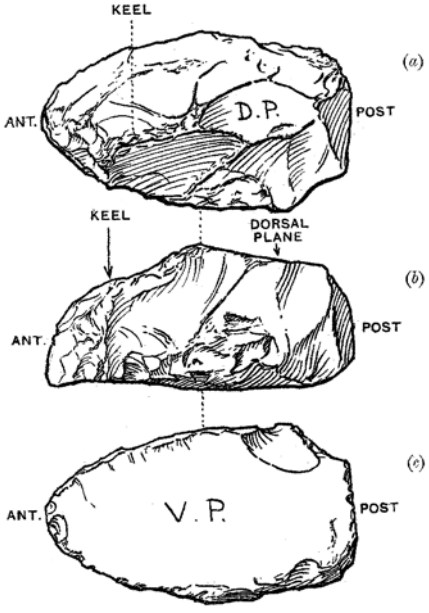


FIG. 6.—VIEW OF (*a*) DORSAL SURFACE ; (*b*) LEFT LATERAL SURFACE OF ROSTRO-CARINATE IMPLEMENT SHOWING FOURTH STAGE OF EVOLUTION ; (*c*) VENTRAL SURFACE. (⅔ NATURAL.)

Fig. 8 After Reid Moir .

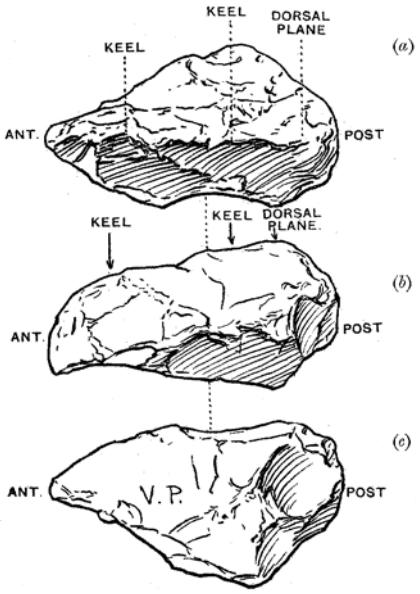


FIG. 7.—VIEW OF (*a*) DORSAL SURFACE; (*b*) LEFT LATERAL SURFACE OF ROSTRO-CARINATE IMPLEMENT SHOWING FIFTH STAGE OF EVOLUTION; (*c*) VENTRAL SURFACE. ($\frac{2}{3}$ NATURAL.)

Fig. 9 After Reid Moir.

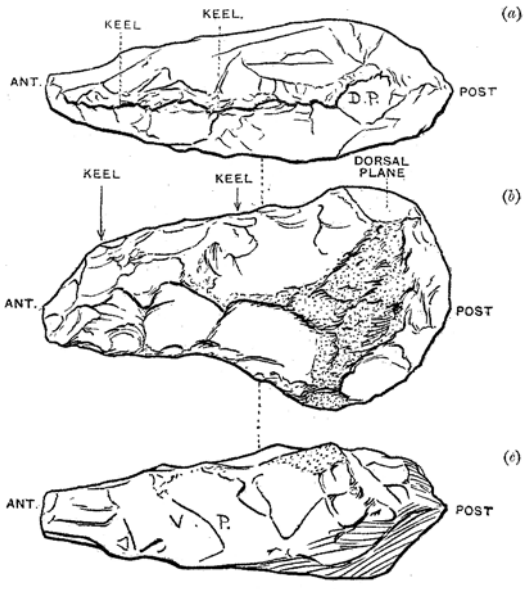


FIG. 8.—VIEW OF (*a*) DORSAL SURFACE; (*b*) LEFT LATERAL SURFACE OF ROSTRO-CARINATE IMPLEMENT SHOWING SIXTH STAGE OF EVOLUTION; (*c*) VENTRAL SURFACE. ($\frac{2}{3}$ NATURAL.)

Fig. 10 After Reid Moir.

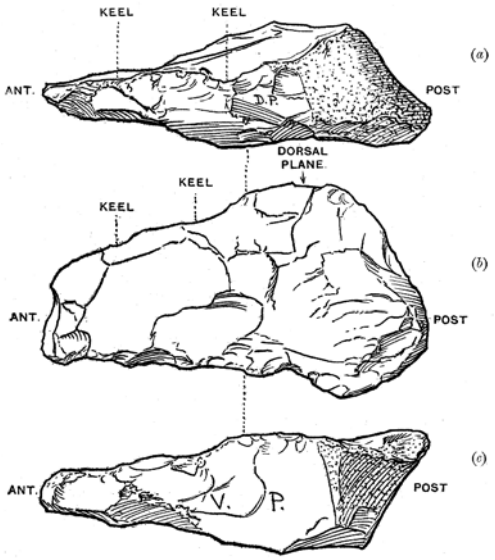


FIG. 9.—VIEW OF (*a*) DORSAL SURFACE; (*b*) LEFT LATERAL SURFACE OF ANOTHER ROSTRO-CARINATE IMPLEMENT SHOWING SIXTH STAGE OF EVOLUTION; (*c*) VENTRAL SURFACE. (⅔ NATURAL.)

Fig. 11 After Reid Moir.

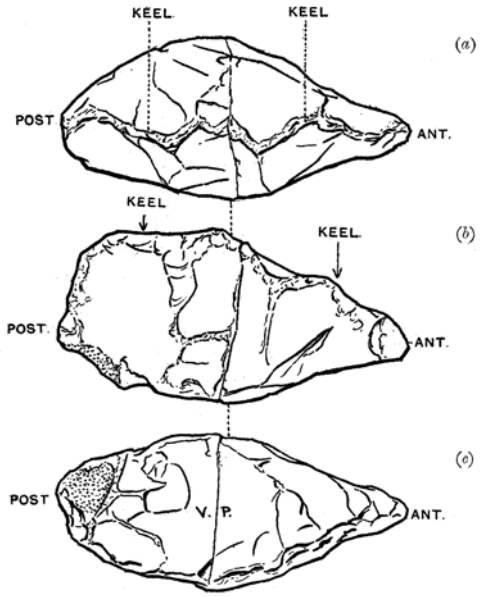


FIG. 10.—VIEW OF (*a*) DORSAL SURFACE; (*b*) RIGHT LATERAL SURFACE OF ROSTRO-CARINATE IMPLEMENT SHOWING SEVENTH STAGE OF EVOLUTION; (*c*) VENTRAL SURFACE. (⅔ NATURAL.)

Fig. 12 After Reid Moir.

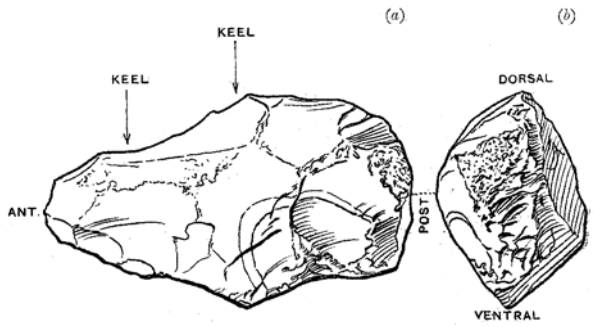


FIG. 11.—VIEW OF (a) LEFT LATERAL SURFACE AND (b) STERN (RHOMBOIDAL IN SECTION) OF EARLY CHELLES PALÆOLITHIC IMPLEMENT, SHOWING FORM EVOLVED FROM ROSTRO-CARINATE. (⅔ NATURAL.)

Fig. 13 After Reid Moir.

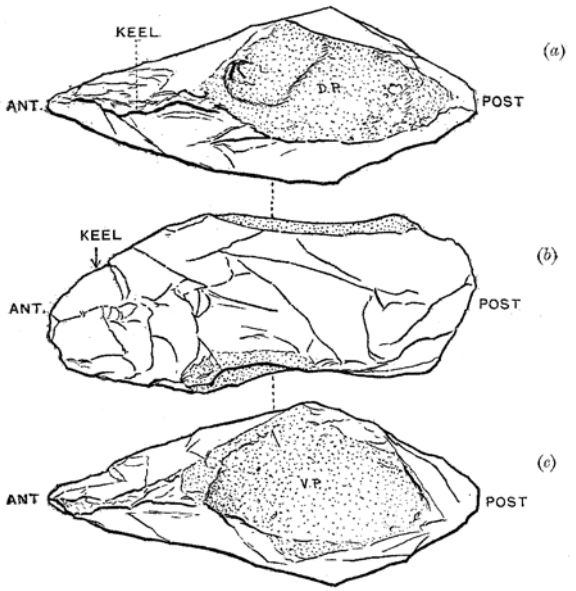


FIG. 12.—VIEW OF (a) DORSAL SURFACE; (b) LEFT LATERAL SURFACE OF PALÆOLITHIC IMPLEMENT OF CHELLES TYPE SHOWING ADVANCE ON PREVIOUS FIGURE; (c) VENTRAL SURFACE. (⅔ NATURAL.)

Fig. 14 After Reid Moir.

Reid Moir's production of evidence through serialization gained strong support when he discovered what seemed to be a Pliocene workshop actually containing different stages of the tool-shaping process from the rostro-carinate to the earliest Chellean types.[28] It was in fact this new evidence of an in situ series that convinced the great French archeologist Henri Breuil of the human workmanship of these tools, and that led to a peak of eoliths acceptance in Europe and the U.S. Of course, the experimental

28 Reid Moir 1921.

FIG. 1.—*Stratigraphical Table of the Implementiferous Deposits of East Anglia.*

Geological Periods.	Climate.	Deposits.	Cultures.
Recent.	Temperate. ...	Surface soil and latest alluvium of valleys	Neolithic and later.
P	? Cold	Deeper levels of alluvium in valleys ...	Magdalenian and ? Solutrean.
L	Glacial	Brown Boulder Clay, Hill Washes, and ? Flood Plain Gravel	Derived Implements.
E	Warm in earlier part.	Floors in lateral valleys, Ipswich	Aurignacian and Mousterian.
I	Glacial	Upper Chalky Boulder Clay	Derived Implements.
S	Inter-Glacial ...	Brickearths and Gravel, Hoxne, High Lodge and Ipswich	Clacton III and late Acheulean.
T	Glacial	Kimmeridgic Chalky Boulder Clay and ? Contorted Drift	Derived Implements.
O	Inter-Glacial ...	Corton and ? Mundesley Sands ("Middle Glacial")	?Lower Acheulean.
C	Glacial	Cromer Tills and ? Norwich Brickearth ...	Derived Implements.
E	Inter-Glacial ...	Cromer Forest Bed, ? Norwich Crag in part, and ? Foxhall horizon	Chellean and Pre-Chellean.
N	Increasing Cold ...	Red Crag	Some derived Implements.
E		Suffolk Bone Bed	Eolithic.
Pliocene	Warm	Coralline Crag.	Some derived Implements.
		Suffolk Bone Bed	Eolithic.
Eocene	London Clay.		

The Red Crag and the Suffolk Bone Bed.

Fig. 15 Stratigraphical Table of East Anglian deposits containing implements after Reid Moir.

and typological series had ramifications beyond the archeological series. Reid Moir further abstracted his serial representation of a serial production and analogous evolution process into tables with parallel columns. In these highly schematized representations, the overlapping arguments from series – geological, cultural, typological, and processual – were played out simultaneously.

However, one column is conspicuously missing from Reid Moir's table shown in Figure 15: the one showing the fossil hominid remains. Reid Moir was aware that in this visual argument the placement of fossil human bones in the column adjacent to the tool cultures at the same level as the Eolithic industries would be the strongest sup-

port for their human workmanship. He therefore was not content with the introduction of fossil-less taxa, as de Mortillet had done, but set out to find the remains of an eoliths-shaper. As early as October 1911, he thought his wish had come true, when a partial human skeleton was found beneath the Chalky Boulder Clay near Ipswich. Reid Moir sent the bones of the possible maker of the Suffolk eoliths to no lesser authority than the anatomist Arthur Keith, conservator of the Museum of the Royal College of Surgeons. Although Keith found that the bones were of a modern anatomy, could not be said to be fossilized (mineralized), and still contained a comparatively high percentage of organic matter, he concurred with Reid Moir's ascription of the skeleton to the Pliocene.[29] At least the anatomical features fit into the growing belief that hominids of a relatively modern body had existed much earlier than so far suspected. Ipswich Man never gained general acceptance, but as the belief in eoliths grew, many scientists tried to fill the void in the paleoanthropological column. There was first of all Piltdown Man, a spectacular discovery made in a late Pliocene or early Pleistocene deposit at Piltdown, in Sussex, in 1911 and 12. Piltdown Man was a forgery; but it took decades to expose the bones as that of a modern human skull and an orangutan jaw.[30] Besides Piltdown Men, Homo erectus-like races were proposed as having roamed Pliocene England. In his book *The Antiquity of Man in East Anglia*, Reid Moir, too, suggested the necessity of a paleoanthropological series matching the archeological one:

> So far as actual evidence of man's former presence goes, we have in East Anglia, as those who have read these pages will, I think, agree, a wonderfully complete record of nearly every stage in human progress from the earliest and most primitive flint implements, to the advanced types made at the close of the Stone Age. Thus, it is possible, that what is now England was the home of the earliest men, and there can be little doubt that if a tithe of the money spent upon researches in other parts of the world were expended upon archaeological work in Eastern England, still further and more important discoveries, bearing upon the question of man's origin, would be made.[31]

The progressive series of archeological cultures through the series of geological layers referred to the existence of a series of hominid types that must have improved step by step in anatomy and mind. That such a success story had taken place on the soil of Reid Moir's home country made English archeology appear like a patriotic duty. However, such interpretations of local series were by then contested. In fact, it was especially this aspect that had been strongly opposed by eoliths-skeptics such as the famous French paleontologist Marcellin Boule. Due to their migratory model of human evolution, they

29 Reid Moir and Keith 1912.
30 Sommer 2008.
31 Reid Moir 1927, 162.

had no problem accounting for the sudden appearance of a relatively sophisticated culture in Europe, the Chellean, without any precedent. They had no need of eoliths and their derivates.[32] To the contrary, for Reid Moir and Keith, the search for the remains of modern Englishmen in Pliocene deposits was embedded in the idea that each modern human race had evolved a long time ago in the area where it was now found.

While the evolutionary scenarios that emphasized migration often drew direct parallels to historical and contemporary processes of imperialism, Keith might well have been motivated by a desire to distance the 'European races' from non-European ones – and ultimately the English from the rest of Europe – by providing them with long parallel evolutionary lines. During the war years, Keith began to develop the theory that human evolution had been driven by racial conflict; he even suggested that current nations were in a race-formation process. Lankester, on his part, seems to have envisioned the shapers of the eoliths as pertaining to the Nordic master race.[33] In his 1912 paper, he speculated that the Tertiary tools of Suffolk and Kent were made at a time when England was still connected to Scandinavia by a land bridge. The Pliocene races might thus have reached England from the very north of the European continent. Clearly, the idea of a Tertiary toolmaker in England flattered British national pride: "There is, perhaps, no other part of the world richer in remains of our remote ancestors than that of Suffolk and Norfolk […]."[34]

3 Henry Fairfield Osborn: Eoliths and a story of serial progress free from apish stain

When the eoliths traveled to America, the paleontologist and president of the AMNH, Henry Fairfield Osborn, eventually became so enthralled with the visions of prehistory they held that he financially supported Reid Moir's research and used his tight network with the English and French communities to help stabilize them as tools.[35] This move coincided with the apex of the tendency of thinking of modern human anatomy in terms of a great antiquity. Osborn eventually made the hominid line bypass even that of the anthropoids. In the United States, evolutionary theory and Osborn in person were attacked by William Jennings Bryan and like-minded in the upsurge of religious fundamentalism, and the bulk of the spite was directed at the 'ape theory' of human origins. In combination with Osborn's own religious background, much has been made of this context by historians of anthropology in explaining Osborn's Dawn Man theory as a strategy to soften protest and to gratify his own desire for the compatibility of religion

32 Boule 1905.
33 Sommer 2007, 197–212.
34 Reid Moir 1927, Preface.
35 AMNH, Osborn Papers; Sommer 2010.

and evolution. In this view, it was for religious and political reasons that Osborn freed human ancestry from the stain of the ape and the primitive.[36]

However, Osborn's extreme Dawn Man theory was rather the apotheosis of preceding international tendencies than an altogether local and idiosyncratic phenomenon. It was furthermore in line with a set of theories that located the origin of the hominid branch in Eocene lemuroids or tarsioids.[37] Although the specific American religious context is important for this acumination, there are other developments that need to be taken into account. Osborn did not immediately embrace the English eoliths and the Piltdown fossils – those hallmarks of speculation about a dawn-age human ancestor of relatively modern anatomy. In the book *Men of the Old Stone Age* of 1915,[38] he only included a quick note on the tools found in Europe and claimed to be of Tertiary age. He shared the doubts of the great men of archeology.

By the time Osborn changed his mind about the supposedly Tertiary European bones and tools, several developments had converged. He had become aware of a quasi-modern horse in the Pliocene. Drawing inferences from the paleontological on the paleoanthropological series, this Pliocene horse alerted Osborn to the possibility of hominids of a relatively modern anatomy in this early epoch. Furthermore, in 1917, bone fragments of a second Piltdown Man had been discovered that swerved general opinion in favor of acceptance, and that Osborn went to examine in the British Museum in 1921. In the summer of the same year, Osborn visited the British sites in East Anglia and Suffolk, and Reid Moir's discovery of a workshop containing a production series finally did its part in convincing him of the existence of Tertiary Man. On his return to New York, Osborn made this conviction public in *Natural History*,[39] and soon thereafter, it was confirmed by the leaders of the archeological community, Breuil and Louis Capitan. From there, the acceptance of eoliths grew to a peak and the East Anglian tools found their way into the Hall of the Age of Man and the Archeological Hall at the American Museum of Natural History. Osborn eventually published newspaper articles to create a stir among those who still clung "fondly to the ape ancestry theory". It was only now that he pushed to their conclusion the dawn-man theories that were associated with European Tertiary Man as toolmaker.[40]

When Osborn expelled the ancestors of the great apes from the hominid line, the branch leading to modern humans became long indeed; and there were no fossils left to

36 Areson Clark 2008, ch. 6, here especially 115–116; Gould 1989; Rainger 1991, 231–232; Regal 2002, particularly 154–173.

37 Drinker Cope 1893, 316–335; Wood Jones 1919; Wood Jones 1929.

38 Osborn 1916 [1915].

39 Osborn 1921; also Osborn and Reeds 1922.

40 AMNH, Osborn Papers, correspondences with J. Reid Moir (Box 15, Folders 15–17), N. Nelson (Box 16, Folder 11), G. E. Smith (Box 20, Folders 15–16), and A. Smith Woodward (Box 23, Folder 31); for the quote see letter from H. F. Osborn to J. Reid Moir, February 1, 1927, Box 15, Folder 16. – Reid Moir did not agree that his discoveries contradicted a common ancestry for apes and humans (Feb. 5, 1927).

occupy it. However, this did not amount to a denial of evolution – as has sometimes been suggested. There was nothing a priori 'creationist' about this move. As we have seen, anthropologists searched for the fossil remains of Dawn Man and used non-ancestral hominids as models for ancestral ones of a more distant age. Most importantly, the eoliths and their evolution were the strongest precarious 'evidence' for the dawn men and their ascent. This is where series retained their persuasive power.

Osborn's *Man Rises to Parnassus: Critical Epochs in the Prehistory of Man* of 1927 was designed as another edition of *Men of the Old Stone Age*. However, because Osborn had "witnessed proofs of the existence of intelligent man and his flint culture over 1,250,000 years ago", a new title seemed in order. Osborn's conception of human evolution was so processual that it was theatrical; he made it unfold in front of the reader's eyes in a series of acts that successively fleshed out the parallel geological, archeological, and paleoanthropological series for each horizontal layer. To this purpose, he used Aeschylus' description of the progressive development of human reason, language, and the practical arts and sciences in "Prometheus Bound" – his account of man's gradual rise to Parnassus – as a structuring device.[41] For good reason, the book is not titled 'Man's Rise to Parnassus', but *Man Rises to Parnassus*. Its form imitates the Greek drama, including prologue and epilogue. The rising of man towards the top of Parnassus is re-enacted as driven by demigods like Prometheus, by the pioneers and innovators of humankind.

As a mechanism for man's gradual rise, Osborn suggested a steady increase in intelligence in a process of co-evolution with tool technology. He traced the insights into the role of a trained hand in mental development back to Anaxagoras:

> Expressed in modern terms, manual training is one of the modes of mental training. In this sense the use of the hand becomes one of the causes of the development of the brain. In my own observation, in the enormously long period of the Stone Age the working of flint tools was the chief stimulus to the working of the mind. So there is a strong prehistoric argument for this thought of Anaxagoras.[42]

This is where the Tertiary tools from East Anglia came in that were now given a full chapter. Osborn in fact based the first acts in his drama of human evolution mainly on the eoliths. In absence of fossil evidence of Tertiary humans, Osborn's performance of the Dawn Man drama only worked if tool cultures could stand in for hominid types. Osborn therefore experimented on his own tool typological evolution – or more precisely, he forced his curator Nels Nelson to do so. Fig. 16 is a beautiful series of archeological cultural layers combined with the attempt to establish evolutionary lines throughout the typologized series. And just like the fossil evidence was inferred to reach back to an

41 Osborn 1927a, ch. 1.

42 Osborn 1927a, 11.

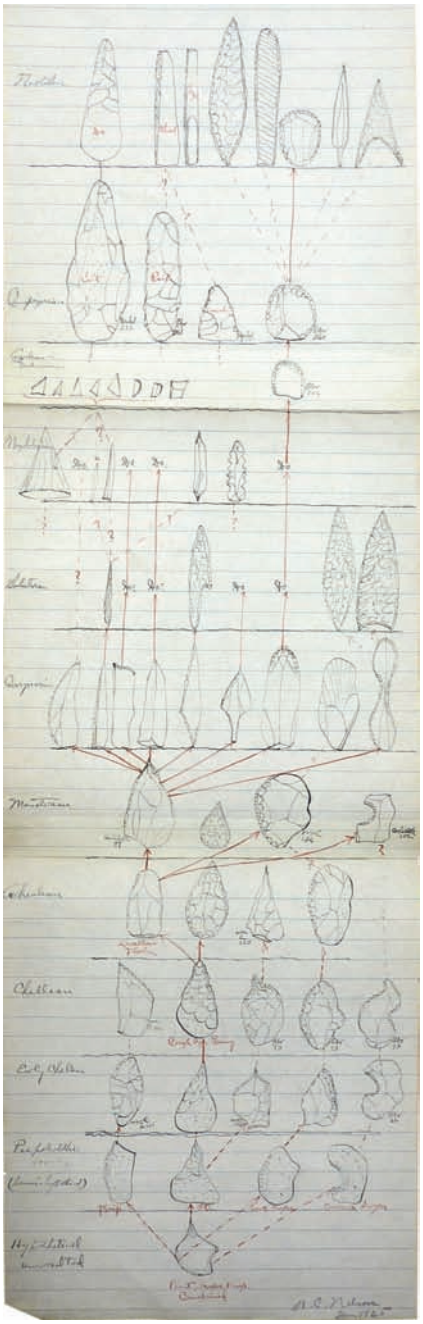


Fig. 16 "Rough scheme suggesting some of the possible genetic relationships of the successive levels of typical stone implements found in Western Europe". Drawing by Nels Nelson.

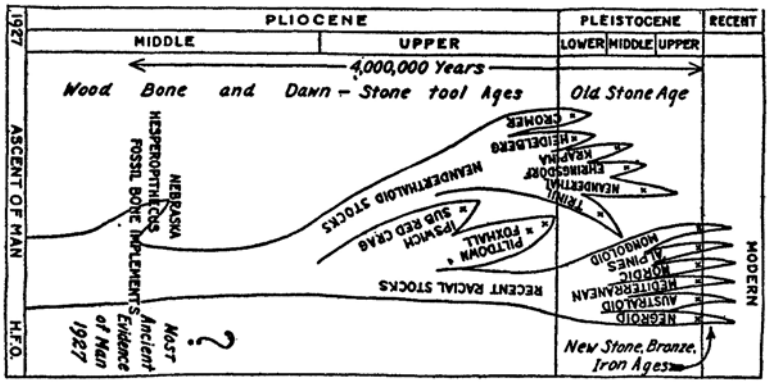


FIG. 1.—Prehistoric and recent racial stocks. Neanderthal stocks (left); partly known Pliocene stocks (center); six Pleistocene and recent racial stocks (right). (Below) Level of the supposed fossil bone implements of the Hesperopithecus quarries in Nebraska—possible evidence of Middle Pliocene bone-tool age in America.

Fig. 17 Visualization of prehistoric and recent racial stocks by Osborn.

as-yet unfound Dawn Man, at the beginning of this tentative cultural evolution stands a hypothetical universal tool. That there was a connection to the by now tree-like structure of hominid phylogeny becomes clear from the Osbornian imagery. In Fig. 17 the "[p]rehistoric and recent racial stocks" are inferred in certain cases from osseous remains and in others from archeological finds.

The inference of hypothetical dawn men from Eolithic cultures depended on the intertwining of series that we have seen carried out in France as well as England. In Osborn's table that was included in the 1924 guide to the Hall of the Age of Man, a cultural, a racial, and a paleontological series were visually brought together, so as to make the viewer mentally substitute the gaps in one column with the content from both or one of the other two (Fig. 18). If such images did not suggest to the museum visitors parallel progressive lines of parallel progress in culture, anatomy, and environment, I know not what would have. Of course, as Figures 16 and 17 illustrate, for Osborn, these columns did no longer represent simple evolutionary series. His ascent of man was complicated by his viewing every material evidence of hominids as a kind of shadow of what had already happened on the line leading to living humans. Nothing seemed good enough for Dawn Man.

But even as shadows of true ancestors, Osborn wanted to rehabilitate the prehistoric human types. His advocacy of their manual dexterity and correlated mental prowess on the basis of eoliths was itself a spiritual quest. The long search for the bones of the perfect, large-brained Dawn Man, to fill the void created by the Eolithic cultures in our direct ancestry, was never achieved; but there was hope in his shadows:

STONE CULTURES		HUMAN RACES	CONTEMPORARY MAMMALS
HISTORICAL		PERIOD	EXISTING MAMMALS
NEOLITHIC		PERIOD	MASTODON(?)MAMMOTH
AZILIAN MAGDALENIAN SOLUTRIAN	PALEOLITHIC	GRENELLE CRÔ-MAGNON	
AURIGNACIAN		GRIMALDI	
COLD MOUSTERIAN		NEANDERTHAL	REINDEER MAMMOTH WOOLLY RHINOCEROS
WARM MOUSTERIAN			ELEPHAS ANTIQUUS HIPPOPOTAMUS
COLD ACHEULEAN			
WARM ACHEULEAN		KRAPINA	
LATE CHELLEAN		EHRINGSDORF	
CHELLEAN			ELEPHAS ANTIQUUS HIPPOPOTAMUS
EARLY CHELLEAN			ELEPHAS ANTIQUUS
		HEIDELBERG	RHINOCEROS ETRUSCUS HIPPOPOTAMUS SABRE-TOOTH
CROMERIAN			ELEPHAS PRIMIGENIUS MUSKOX
		PILTDOWN?	REINDEER
FOXHALLIAN			

Fig. 8. Sequence of Old Stone Age (Paleolithic) in Europe.
The order in which the races of primitive men appeared in Europe and the most striking mammals living at the same time.

Fig. 18 Osborn's 1923 sequence of Palaeolithic men and animals.

On Sunday morning, July 24 [1921], after attending a most memorable service in Westminster Abbey, the author repaired to the British Museum to see the fossil remains of the now thoroughly vindicated Dawn Man of Great Britain [i. e. Piltdown Man, M.S.]. The few precious fragments of one of the original Britons,

> which had been preserved in a steel fireproof safe from the bombs thrown by German aviators and which will probably be thus guarded from thieves for all future time, were taken out and placed on the table by Smith Woodward [keeper of palaeontology at the BMNH and strong promoter of Piltdown and eoliths], so that full and free opportunity was given for the closest comparison and study.[43]

This scene of worship at both the religious and the scientific altar represents the climax of Osborn's quest for the origin of human spirituality. The scene at once makes clear that religion and science are not at odds; that his scientific search for truth is inspired by a belief in God. But scientific truth will not be obstructed by religious fundamentalism, or by enemies of civilization such as the Germans, and certainly not by common thieves. The scientific fetish presented to Osborn on the museum's altar is palpable evidence of the victory of scientific reason over religious superstition and human barbarism. The relic of Tertiary Man – with his large brain case – suggests the noble history also of the direct human line, man's steady rise to Parnassus. The house in which it is worshipped is a house of science that stands for equal opportunity, openness, and democratic exchange in a common search for knowledge. But despite this hopeful tenor, the events in world history cast a doubt on the optimistic universal progressive series; a doubt that is audible in Osborn's *Man Rises to Parnassus*: Will the human races continue to rise each to its own capacity? Or will the current interbreeding of types, the lack of struggle in the modern environment, or the puncture of this tranquility in the brutality of war, continue to sap man's virility, as foreign influence had degraded Neanderthaloid culture, as the lush jungle habitat had once kept back the apes, and as some prehistoric tribes had been extinguished by others? At stake was the next stage in human serial ascent.

4 Finis

From the times of de Mortillet, eoliths had been incorporated into pre-existing notions of technological progress, celebrated for example at the great expositions. They were transferred from a very controversial status to a short life as scientific facts through the hard work of translation by English paleontologists and archeologists who gave them strength through incorporation into series: typological series, production series, cultural series, and geological series that themselves were transfused by the notion of linear progress in culture, body, and mind. This idea of progress as structuring the history of life, and human life in particular, lost some of its power towards the end of the century. Simultaneously, scenarios of human evolution began to take the shape of 'trees'

43 Osborn 1927a, 52–53.

with many dead-ending branches. In the dawn-man theories, there were no fossils to animate the long surviving line. This at first glance seems to signify a vehement breakdown of the serial argument. However, as in the case of Osborn, inferences about the human ancestral line could be made from Eolithic cultures, from non-ancestral fossils that could stand in as models for earlier ancestral ones, and also still from 'primitive living humans.'

In spatial arrangements, verbal performances, and visual representations of human evolutionary history, the parallel progressive series continued to structure an overall steady progress propelled in a mutual catalyzing between environment, tool-invention and -fashioning, motor skills, intelligence, and psychology. This not only hints at some continuity in scientific argument and thought. The retaining of verbal and visual strategies from the old paradigm also increased the problem of unambiguous knowledge transition, especially to wider publics, as I have discussed at the beginning of the paper for the primate tree in the Hall of the Age of Man showcase. Finally, from their beginnings, eoliths were not purely epistemic, but also political objects. They became enmeshed in views of the prehistoric past that carried diverse but strong lessons for the present: the inevitable succession of political systems in socialist aspirations, the long history and noble identity of European nations increasingly in competition, and the warning against interbreeding and other supposedly negative consequences of modernization. These histories and their incumbent futures were themselves serially structured; the spatialization, narration, and visualization of series of objects, events, and developments on all levels from tool typology to universal progress mutually reinforced each other and gave the eoliths the evidential power that fed back into the series.[44]

44 Sommer 2010; Sommer 2004.

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