

Here you stand, close to the first — undecipherable — stone....
 (Derrida, *Diasemination*, 358)
 ...the Stone which is not a stone...
 (Rulsand, *A Lexicon of Alchemy*, 189)

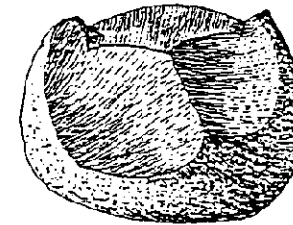
TWO MILLION YEARS AGO: THE ORIGINS OF ART AND SYMBOL

James B. Harrod

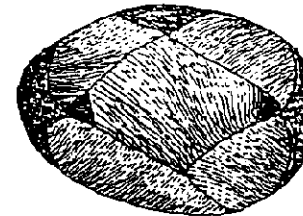
It is generally accepted that the human species invented art, symbol, and religion during the Upper Palcolithic, as evidenced, for instance, in the cave art and female figurines of Europe, dating from about 40,000 to 10,000 years before the present. Some, such as Teilhard de Chardin, have suggested that the tools and fire-making associated with *Homo erectus* permit an inference of “mind” or “spirit” several hundred thousand years ago. In this essay I will indicate how the birth of art, symbol, and religion, of the human “mind,” “spirit,” and “psyche,” occurred over two million years ago.

The earliest hominid stone tools — dated to around two million years ago — were found first at Olduvai Gorge, Tanzania, and subsequently at Koobi Fora, along the northeast side of Lake Turkana — the “Jade Sea,” one of the longest lakes in the world — and at other sites in the Rift Valley of Kenya and Ethiopia. This stone tool industry is usually designated “Oldowan” after the initial discoveries at Olduvai Gorge. These earliest human stone tool assemblages, sometimes referred to as “pebble tools” or “chopper core-chopping tools,” are made by using a hammerstone to chip sharp flakes off pebbles and cobbles. The result is a flaked core, some flakes, and some waste fragments of stone. (See Fig. 2a-k for typical Oldowan tools.)

At the Koobi Fora Museum in Kenya, I examined a display of two-million-year-old stone tools from the East Turkana area. Among some an-



a



b

Figure 1. FxJj1 #302, bifacial chopper core (a) side view, (b) top view, 3/4 actual size (drawing Patricia Reis).

gular cores and flakes, I was struck by one unusual, distinctive core. Bearing a site designation and catalogue number: FxJj1 #302, it was an egg-shaped basalt pebble about three inches long, with five flakes removed. Archaeologists refer to such a tool variously as a “bifacial chopper,” a “choppingtool,” or simply a “flaked core.” A pair of flakes had been removed from each side, and a fifth fractured off along a cleavage plane. This fifth flake may have been an accident, or, perhaps, intentionally struck. In any case, the result was a perfect diamond shape, stunningly symmetrical and centered in the four flaked areas (Fig. 1a, b).

DOCUMENTS OF STONE

Mircea Eliade suggests that the earliest document in the history of religions is located in the symbolism of stone tools, tools to make tools.

It is inconceivable that tools were not charged with a certain sacrality and did not inspire numerous mythological episodes. The first technological discoveries — the transformation of stone... — not only insured the survival and development of the human species; they also produced a universe of mythico-religious values and inspired and fed the creative imagination... The semantic opaqueness of these prehistoric documents is not peculiar to them. Every document, even of our own

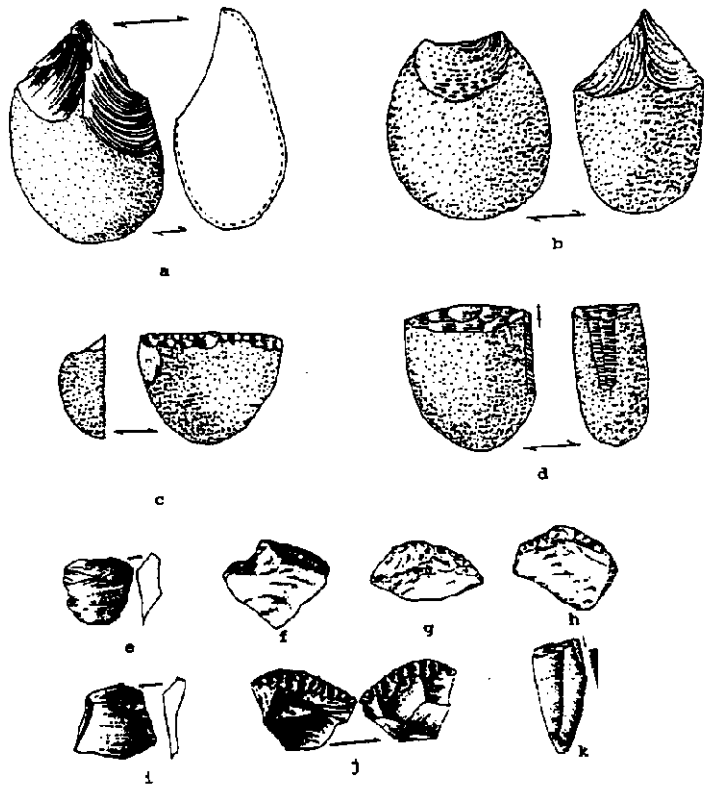


Figure 2. Typical Oldowan tool forms: (a) unifacial chopper; (b) bifacial chopper; (c) core scraper; (d) core burin (after A. Wouters); (e) flake; (f, g, h) flakes showing utilization wear (after M. Leakey); (i, j) two flake scrapers; (k) burin on flake (after A. Wouters).

time, is spiritually opaque as long as it has not been successfully deciphered by being integrated into a system of meanings (1978:6-7).

Indeed, this stone artifact seems charged with just such a sacrality. While it may be too much to speak of "mythological episodes," if one places it in its "system of meanings," which necessarily includes the technological, subsistence, and other innovations by which the Oldowan hominids entered the evolutionary niche of the savannah, this mute stone can speak.

The Oldowan savannah adaptation involved a complex technological strategy, which included stone flakes and cores for cutting and scraping, and the not preserved, but inferred, equipment for containing, binding, and transporting.

Taphonomic studies by Bunn, Shipman, and Potts on bone breakage, bone cutmarks, and features of the association of bones and tools confirm that Olduvai and Koobi Fora hominid tool-users foraged for meat and marrow, probably by actively scavenging large mammal carcasses (in the 250-750 pound range) from competing carnivores, such as lions and hyenas, and by hunting small to medium size mammals (up to 250 pounds). They used flakes to cut, slice, scrape, and otherwise process carcasses. In doing so, they were able to remove skin and tendons, dismember joints, and deflesh bones. Using hammerstones, choppers, or stone blocks, they broke open bones to get at the marrow. Microwear analysis by Keeley and Toth of flakes from the Koobi Fora site of FxJj50, dating to about 1.65 million years ago, confirms that trimmed and untrimmed flakes were used for cutting plants, such as grasses and reeds; scraping and sawing wood; and slitting through animal carcass hides and slicing meat from bones.

Shipman concludes that the locations of cutmarks on bones from Bed I sites at Olduvai Gorge, which date from 1.9 to 1.7 million years ago, suggest that early hominids may have used flakes to remove skin and tendons, possibly to make bags, clothing, and thongs. Isaac infers containers, such as pouches, bags, and baskets, from the evidence of the magnitude of non-indigenous stone artifacts found at early hominid sites. Container use may also be inferred from the wide-ranging foraging behavior that would have been required for savannah survival.

As among contemporary gatherer-hunters, containers might have been made out of animal skins, tendons (sinews), and tissues; bark, twigs, reeds, and grasses; and invertebrate shells and eggshells. Zihlman and McGrew suggest that twigs, grasses, and reeds may have been used to make baskets; animal skins, tissues, and bark, to make bags, baby slings, and items of clothing; and shells, to make containers. Contemporary bushmen make sandals to protect the feet from the hot midday ground. Other types of "containers" may also be inferred, such as shelters, windbreaks, and nests/sleeping platforms.

What is distinctively "human" about the Oldowan technological adaptation? Tool-use and/or tool-making are often considered as behaviors that distinguish humans from other animals, but research on primates indicates that such a distinction is insufficient. Goodall has identified types of tool-use and tool-making among chimpanzees. They select grass or small stems or sticks, and use them to forage, probing holes and crevices of all sorts, and for fishing out termites, ants, honey, and resins. They fashion such sticks by stripping off leaves; and they are known to trim the ends of sticks to make them more pointed. Chimps use long sticks to hook and pull down high, unreachable branches in order to get at fruits. They also employ a stout stick or a hammerstone to crack open nuts and hard fruits. They place nuts against anvils, either rocks or exposed, hard tree roots, and use careful positioning and precise hammering techniques to open a nut without smashing its contents. If chimpanzees are tool-makers and tool-users, what then is, if anything, distinctively human about Oldowan technology?

Toth suggests that human technology is distinctively different from chimpanzee technology. Following Binford's distinction between curated and expedient tools, Toth observes that early hominids transported tool materials and tools over much greater distances and with much greater spans between making and future use than occurs for chimpanzees. Oldowan tools are a "curated" technology, as opposed to the "expedient" technology of chimpanzees. Early hominids had a superior spatio-temporal mental and memory imaging capacity. Gowlett argues the same thing: the human mind can sustain a much longer chain of related actions, and can project plans and actions farther ahead in time than can the chimpanzee mind. But such arguments imply that the difference between chimpanzee and protohuman technology is only a matter of degree, whereas I believe the evidence points to a fundamental, qualitative difference.

THE DIALECTIC OF CORE AND FLAKE

In analyzing the Oldowan industry, Mary Leakey posited various stereotypical "core tools," which she attributed to stylistic norms. More recently Toth, Keeley, and others posit that the cores are simply the by-products of lithic reduction to produce sharp flakes. Which is more important for characterizing the Oldowan industry — core or flake? I do not believe it is an either/or. Core and flake together constitute the essence of the Oldowan stone technology. It is precisely this ambiguity as to which is "the tool" — core or flake — this double possibility, this flexibility as to use that lies at the heart of the radical uniqueness of Oldowan technology vis-à-vis chimpanzee technology. Oldowan stone technology is a "core/flake" technology.

Conceptually, Oldowan core/flake technology involves a complex crisscrossing of cognitive matrices for decision, valuation (curation), and action. Decisions were made whether to save, transport, or otherwise value ("curate") an artifact, or discard it. Decisions were made whether or not to utilize an artifact. Decisions were also made to trim or not trim ("retouch") an artifact. Consequently, the industry includes discarded, waste cores; utilized cores; discarded, waste flakes and flake fragments; and utilized flakes. It also includes flakes treated as if they were cores, that is, flakes that were themselves subject to flaking ("trimming"), the so-called "light duty" or "flake" scrapers, as well as the logical inverse of this, cores treated as if they were flakes, that is, the trimmed cores, the so-called "heavy duty" or "core" scrapers (Fig. 2a-k).

The Oldowan core/flake technology requires dialectical thinking. In this concrete dialectic each term of the pair is potentially equal to the other. A chopper core might be as useful as a flake, depending upon the task at hand. A core scraper might be as useful as a flake scraper. Thus, the Oldowan tool-maker was the originator of the first concrete representation of the mind's capacity for dialectic.

The dialectical logic implicit in the Oldowan stone industry is an eight-fold matrix of core and flake permutations applied to a continuum, the *prima materia* of stone (see Table 1).

This eightfold "core/flake" matrix predicts the possible existence of

Table 1. An Oldowan Technologic

	Degree of Curation (Valuation)	Lithic type
Core	Nonutilitarian -	discarded, waste core
	Nonutilitarian +	curated, aesthetic core: e.g., pyramids, KBS #302, rostrocarinates occidental animal images
	Utilitarian 0	utilized core, core chopper
	Utilitarian +	core treated (retouched) as if it was a flake: e.g., core scrapers
Flake	Utilitarian +	flake treated (retouched) as if it was a core: e.g., flake scrapers, burins
	Utilitarian 0	utilized flake
	Nonutilitarian +	curated, aesthetic flake: e.g., rhomboids, nosed or pointed scrapers occidental animal images
	Nonutilitarian -	discarded, waste flake

nonutilitarian, curated artifacts, in other words, Oldowan "art." The logic of the matrix cautions one to be on the look out for aesthetic cores and aesthetic flakes, and dialectical relationships between them. A review of Oldowan stone tool assemblages suggests that precisely such cores and flakes already have been discovered. Perhaps because infrequent in number compared to other "tools," and perhaps because the consensus is that art could not exist before the Upper Paleolithic, these finds are rarely commented upon, and their integral relation to utilitarian artifacts is usually overlooked.

Examples of Oldowan forms having clearly aesthetic qualities are: (a) pyramidal-shaped polyhedron cores; (b) flakes with rhomboid form; and (c) combinations of (a) and (b), such as rhomboids made on tabular quartzite, or the unique FxJj1 #302, a side chopper core with internal rhomboid. In addition, there are core forms fashioned with unifacial or bifacial symmetrically paired flake removals, which have a special aesthetic quality, including some pointed choppers ("pre-Chellean tools"); so-called "nosed" choppers (or rostrocarinates); and similarly fashioned flakes, including some "nosed" or pointed scrapers and protobifaces (Fig. 3a-f).

Thus, the Oldowan industry presupposes a highly developed field of decision and action significations, which stands in sharp contrast with the most sophisticated example of chimpanzee tool-making, the stick, stripped of twigs and leaves, and sometimes sharpened, used to fish for

Table 2. A Chimpanzee Technologic

	Degree of Curation (Valuation)	Vegetal Type
Stick	Discarded (repeat) -	discarded, waste leaves, twigs (discarded trimmings from point)
	Used (repeat) +	utilized probe (re-used probe)
Stone	Discarded (repeat) -	discarded (re-discarded)
	Used (repeat) +	utilized hammerstone (re-used hammerstone)

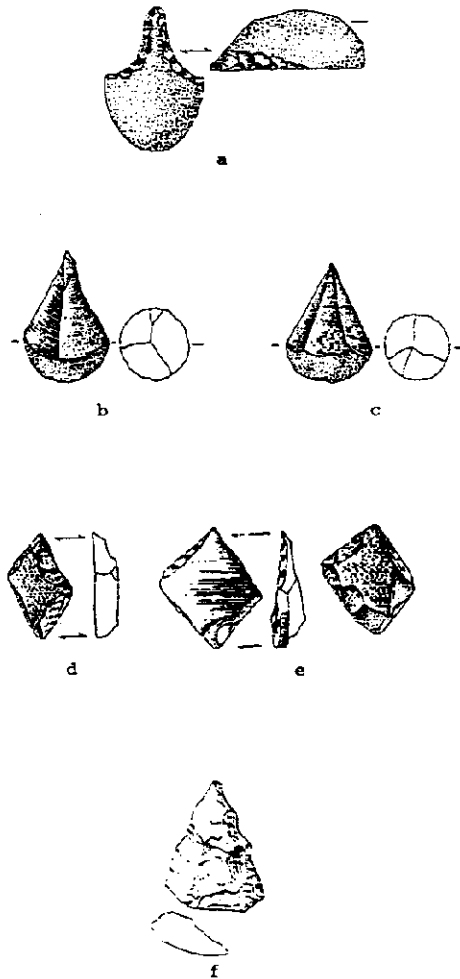


Figure 3. Typical aesthetic artifacts: (a) rostrocarinate on split core; (b, c) two pyramids; (d, e) two rhomboids from Ede II, Netherlands, 0.8 MYA or earlier (after A. Wouters); (f) trimmed pointed flake, FxJ1, 1.88 MYA, Koobi Fora (after G. Isaac).

termites. The chimpanzee pursues a “core” that can penetrate and probe, the rest is discarded. The decision-logic is one of discard or use, with only a repetition of discard or use imagined. There is a single bifurcation repeated *ad infinitum* (Table 2). Such a simple tool lacks the triply bifurcated, dialectical decision-making process of the Oldowan hominids, who could use core or flake, core flake or flake core, and even “curate” a core or flake in a “magical realm” of neither use nor discard — where something *is* for its own sake. It is not simply tool-using or tool-making that is distinctively human — but something else, namely, the peculiarly human dialectical thinking that is reflected in the Oldowan stone tool industry.

In the preceding, the focus has been on the product, the form created. A functional analysis of Oldowan stone technology reveals a further distinctively human complexity. While a number of animal species use tools or implements, it is distinctive of the human species to use tools to make tools. Thus, the difference between chimpanzee tool-use and protohuman tool-use is one of radical indirectness, of delayed gratification, of deference. The Oldowan tool-maker enters a realm at one remove or two removes from the gratification of a drive. The chimpanzee makes a tool for direct use, as if it were an extension of the body, the hand’s grasp. That which is prepared, put in a certain order, or made ready is directly or immediately related to or projected toward the object of desire. On the other hand, for the Oldowan hominid that which is to be made constitutes a realm of “preparation” or “readiness” that is separate from the object of desire. It is a region of second-order preparation, of pre-preparation. It is a region of second-order ends, ends which, in turn, become means to final ends. It is a region of multiple projection, of multiple potentialities, of dialectical

tical possibility, including dialectically related means (core or flake) and dialectically related ends.

The dialecticity "core/flake" is not a form, a shape, or copy of a mental image imposed upon a formless substance (a notion which probably could not have been grasped until the Acheulian times of *Homo erectus*). The concept "core/flake" precedes any such notion. It is the name of a procedure, an action. It is the primordial division (*diarexis*) of chaos, the separation that creates an imaginal, second-order world, the screen of a splitting, a projection of splitting, of paring, of pre-paring. "Core/flake" is the "deconstruction" of stone.

OLDOWAN MIND/ORIGINAL MIND: A DISASSEMBLAGE

The gap (between us and our nearest living relatives, the apes...) is largest, and most difficult to comprehend, in terms of mind... There is a human element, even millions of years ago, which cannot be reduced out of existence.

(Gowlett 1984: 167, 188)

The Oldowan dialectic in stone tells us something fundamental, something about the origin of the human mind itself, the distinctively human mind. In seeking to grasp this, the fundamental ground of philosophy itself becomes raised into consciousness.

Based on characteristics of Oldowan stone technology Wynn and Gowlett have made inferences about the cognitive powers of Oldowan hominids. Drawing upon Piaget's genetic epistemology, Wynn convincingly argues that Oldowan hominids possessed "pre-operational" intelligence. Pre-operational structures are internal imitations of action sequences, which involve internal representations (mental imagery, memory of past actions, projection of an action into the future). Pre-operational action sequences employ such organizational features as trial-and-error for feedback in fulfilling an intention. Pre-operational intelligence is also typical of modern pongids.

Wynn identifies the elemental concepts employed by the Oldowan mind to produce core/flake tools by focusing on the spatial "logic" inherent in them. The polyhedron is geometrically the simplest of artifacts in the Oldowan assemblage. It requires only a concept of proximity, the relation of "nearbyness." The stone worker needed only to place successive flake removals near to one another to yield a polyhedron. More complex Oldowan artifacts require a relation of order, in which proximities are ordered by a constant direction of movement. The simplest kind of order is "the pair," one element placed next to the one preceding it. A chopper results from striking a flake from a platform supplied by a previous flake removal. The simplest chopper consists of two flake removals, one right next to the other, to produce a functioning edge. Most choppers have more than two flake removals, but the minimum co-ordination is still that of "the pair." Scrapers are more sophisticated; a notion of constant direction must be added to "proximity and separation."

Wynn notes that while chimpanzees' tools, such as probes for termiting, evidence pre-operational thinking, Oldowan tool-making is more complex. For instance, a probe does not require proximal placement of elements, only removal. Gowlett argues that Oldowan hominids had a somewhat higher level of intelligence. The Oldowan stone workers had knowledge of the flaking properties of various types of stone, and mastery of complex multi-step routines, involving selection of the right material, right force, and the right striking angle. He notes that the Oldowan knapper began with a pair of flakes and worked from both sides, yielding a "bifacial" edge. The same basic technique is described by Toth: a first flake is struck off, making a "striking platform," which has an acute angle; the next flake is struck from the platform. The platform has now reappeared on the opposite face. So the core is flipped over and the next flake is struck from the new platform, and the process continues by the alternate flaking of opposing faces of the core.

Wynn's analysis has identified some basic cognitive structures in the Oldowan mind: "proximity or nearbyness," "separation," and an order relation, "the pair." From Gowlett and Toth's analyses it is clear that such concepts as "opposite faces," "this side/other side," "upper side/lower side," "front/back," and so on must be added to the notions of "the pair," "nearbyness," and "separation."

Drawing further from Piaget, the Oldowan pre-operational intelligence would have employed "representative regulations," which enable thought about states and transformations as "semi-reversible" forms. Pre-operational thought can grasp "duality" of states and transformations, figural collections and thoughts as configurations of concrete things. Such abilities correspond closely to the duality of the action sequences in the technologic of the Oldowan stone tool industry analyzed earlier. Such an evolved pre-operational mind would be well suited to employing, understanding, and communicating the dialectic of core and flake.

Alexander attributes to the Oldowan hominids the entire collection of activities and tendencies that make up human mentality, including consciousness (self-awareness, conscience, intent, scenario-building and testing, thought, imagination, representational ability, etc.); cognition (logic, reasoning, problem-solving ability, etc.); semiotic ability; emotions; and personality traits. His focus is on intergroup, conspecific competition as the driving force of evolution, including evolution of the psyche as adaptation. Alexander expands the notion of mind to include a wide array of mental capacities, and emphasizes one aspect of affectivity, competition. Thus building upon Wynn, Gowlett, Alexander, and Piaget, the Oldowan mind would appear to comprise four basic experience-organizing capacities: conception, imagination, essentialization, and affectivity, each with its own dialectical structure.

The dialectic of conception, which structures Oldowan pre-operative thinking as a whole, comprises four elemental concepts: "nearbyness" (proximity, contiguity), "separation" (apartness, standing apart, pulled apart), and the order relations "the pair" (what goes or fits together, complements, complementarity, duality) and "opposites" (opposite or alter-

nating loci, such as this side/that (other) side, top/bottom, upper/lower, above/below, front/back). These concepts are a figurative collection and a configuration of things, imagined and enacted routinely in stone flaking operations and in the making of such things as containers and binders, which "hold together" things.

The Oldowan mind was capable of an elemental dialectic of the imagination, which may be taken as original and originary in the human mind, which imaged a series of dialectically related themes: "parings" (flakes)/"core" (innards, center, heart); "surface" (cortex)/"matrix" (source, whence, the between, *prima materia*); "outside"/"inside" (inwardness); "this side/beyond"; "bound" (edge, limit, horizon)/"boundless" (vastness); as well as "rind" (hide, bark)/"sinew" (fibre, strengthener); "tie" (binding, together, connection)/"loose"; "container/contents"; "opened up/closed up"; and "visible"/"hidden." These dialectics are implied in, represented by, and reproduced *in action* in the technology of "core/flake" stone tools and "bark/fibre" containers and thongs.

A third basic mental capacity that apparently belonged to the Oldowan mind is the capacity to intuit the essential qualities of something. This capacity is implicit in the dialectic of core/flake. The core evokes a sense of "essence" as that which is intrinsic to the nature of a thing, the flake as something accidental, dispensable, inessential. Or, conversely, the flake is that for the sake of which the flaking is performed, the prerequisite for cutting through a carcass hide into the meat at its core, and everything else is dispensable, inessential, accidental. By a primitive analogical process, every thing, event, or action of experience can be "interpreted as" "core-like" or "flake-like," that is, as having essential and inessential, prerequisite or dispensable qualities. The dialectic of essence bears remarkable similarity to and reverberates with the dialectic of imagination, with such notions as inside and outside, visible and hidden, matrix and surface.

One, two, three, my dear Timaeus, but where is the fourth? The fourth mental function, one noted by both Alexander and Piaget, is affectivity.

Drawing first and foremost upon the affinities between persons, and especially the primal parents, the mind organizes elements of experience with respect to their affinities to each other. With the dialectic of affectivity the mind apperceives what "holds together" the things of the world or what qualities separate or distinguish them. With this capacity, one senses the libidinal cathexis of things, the degree of affective bonding within a thing or between things, and one can operate with and affect these outer and inner bonds. The dialectic of affectivity comprises a fourfoldness of dialectically related themes: "competition" (attraction and surpassing), as emphasized by Alexander; *but also* "affinity" (attraction and cooperation; joining, coupling, love, conjunction); "conflict" (surpassing and repulsion, fighting); and something like "misfitting" (cooperating yet repulsing).

RHOMBOIDS OF THE MIND

Pairs of flakes from opposite sides, pairs of pairs — unifacial and bifacial choppers with pairs of flakes pared away, rostrocarinates, nosed scrap-

ers, pyramid forms, rhomboids — these non-utilitarian, curated artifacts are the embodiment of the Oldowan mind in stone.

The diamond, lozenge shape within two pairs of side flakes of FxJ1 #302 (*Fig. 1b*) is comparable to the unusual rhomboid-shaped artifacts found at chopper-chopping tool sites in northwest Europe, as described by Wouters et al. The latter are made on pieces of tabular quartzite or other material, or on flakes. They sometimes have burin points, sometimes are retouched like scrapers, and sometimes evidence simply the four edges. Examples found at Ede II in the Netherlands are dated prior to 800,000 before the present (*Fig. 3d, e*). Although the Ede II artifacts as a whole seem comparable to more evolved Oldowan traditions (the so-called Developed Oldowan B of Olduvai Gorge), the mental competence required to fashion the rhomboid shape is implicit in the early Oldowan.

Artifacts such as pyramids, rhomboids, and FxJ1 #302 are non-utilitarian, curated forms of stone. That which presents itself in these embodiments is not a means to some end, nor is it a remainder or residual by-product, like the core, of a procedure to make a means to some end. Rather, what presents itself is something which is — or is made — for its own sake, and thereby can represent something which is for its own sake. When philosophers speak of the "essence" of what it means to be human (the human essence or human nature, the self, the person, etc.) as something that is not a means to an end, not something to be used for something else, but as something "for its own sake" (*proprius*), they are referring to this same distinctively human quality.

The haunting mystery radiating from FxJ1 #302 is just this, the wonderful qualities of original mind that it grasps in experience: the Pair and the Opposites — a pair of pairs (the sides of the rhomboid) within pairs of pairs (the four side flakes) — a magical eightfoldness of complementarity; in the Inwardness, Heart, Core, Matrix (*prima materia*), the Source and Whence, the Origin, within the surfaces, the Bounded within the Boundless Vastness, the Hidden emerging from the visible; the For Its Own Sake (the *prius*, the absolute priority, the first and ultimate) and the Intrinsic Essence, the True Substance; and the Affinity (the coupling of love and acceptance, the *coniunctio*) and the Esteemed (that which shines out above all others).

THE ORIGINAL *PRIMA MATERIA*

The Oldowan industry also includes the implements used to make core and flake, namely hammerstone and anvil (*for example, Fig. 4a, b*). This nests the core/flake dialectic within a more encompassing dialectic, and creates a four-term dialectic, a pair of pairs: hammerstone/core/flake/anvil. In between hammerstone and anvil is the raw stone, the pebble. In between is the *prima materia*, the continuum, the medium upon which the dialectical stone-working procedure operates. This *prima materia* underlies (sub-stances), receives, is the receptacle of, a sequence of mental-become-concrete bifurcations designed to yield one or more of the eightfold lithic types.

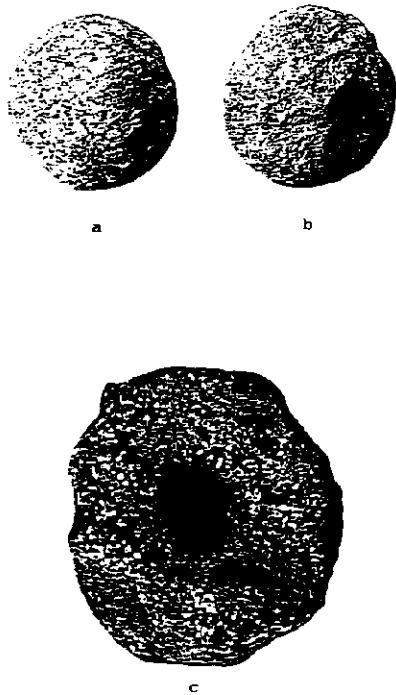


Figure 4. (a, b) two spheroids, FLK North 1/2, Olduvai Gorge, 1.8 MYA, 3/5 actual size (after photo M. Leakey); (c) pitted anvil with artificially pecked depression, FLK North Sandy Conglomerate, Olduvai Gorge, 1.7 MYA, 2/3 actual size (after photo M. Leakey).

The dialectic of hammerstone, anvil, and *prima materia* also appears to have attracted the spiritual imagination of the Oldowan hominids. At the Developed Oldowan sites at Olduvai Gorge spheroid and sub-spheroid artifacts regularly outnumber all other tool types. Many could have been used for hammerstones, since the more smoothly rounded a hammer the more accurately one can flake. However many show no utilization wear, and some are as large as basketballs and weigh up to eight pounds, far too large to be used either as hammerstones or — as proposed by Louis Leakey — bola stones. They were apparently fashioned for their own intrinsic, aesthetic value. The remarkable numbers and size at some sites suggest that here the hammerstone itself takes on a magical quality, representing something “distinctively human.”

Even more remarkable finds exist with respect to anvils. In concluding her analysis of the lithic industries from Olduvai Gorge, Mary Leakey

singles out for mention a grooved and pecked phonolite cobble found in Upper Bed I and dated to about 1.7 million years ago (Fig. 5i). She observes that the cobble, which measures about 3" x 2", has almost its entire cortex removed by pecking and battering. It has a well-marked artificial groove encircling a raised oval area, which is pecked over the entire surface. Experiment showed that the groove is sufficiently deep to hold a thong or string in position if tied round the stone at this point. A line of four symmetrical indentations, about 1/8" in diameter, together with two adjacent pitted indentations run obliquely down a lower side of the piece. She goes on to observe that with oblique lighting, there is a suggestion of an elongate, baboon-like muzzle with faint indications of a mouth and nostrils. This cobble is not much smaller than the anvils from the same site, which are pitted and battered, one having a pecked depression in its center. She compares this find to a manuport jasperite pebble found by Raymond Dart at the Makapansgat site, roughly dated to between 3 and 2.6 million years ago, which has natural markings that simulate at least four primate or Australopithecine faces.

That the Olduvai find was indeed intended to represent a primate is suggested by anvils recently discovered in Northwest Europe and described by Benekendorff. Though dated to only about 500,000 years ago these anvils — which occur in assemblages comparable to the Developed Oldowan B in East Africa — are repeatedly carved in stereotypical figurative shapes, and most prominently baboon heads (for example, Fig. 5a-h). That the baboon might have been the first subject of the human aesthetic — and, perhaps, moral — imagination is tremendously intriguing for what it might say about the deepest strata of the human psyche. It evokes the course of hominid evolution “rooted” like an anvil in the lesser apes as well as the contemporaneous competition between our protohuman ancestors and their distant cousins, the baboons. (Shipman has examined the high numbers of giant baboon kills associated with later Acheulian hominids at Olorgesailie.) It is not necessary to propose that the Oldowan hominids were capable of translating imagined representational forms into stone. The Oldowan baboon-head anvil find could well have been, in whole or part, an accident of nature or the tool-making process, a serendipitous by-product. In any event, it was evidently recognized and treasured for its figuration.

In the between, between the geometrical spheroid, the pure orb, the hammer which strikes down like lightning, and the anvil, the rooted base of the pre-hominid, the baboon, monkey, orangutan, gorilla, chimpanzee from out of which we have evolved, is the pebble stone, the material, the “between,” the “continuum,” the “medium,” the “substance,” the *prima materia*, upon which our humanity is “flaked.” This is the *prima materia* of the opera of the self-becoming of “the human,” that distinctive, intrinsic *prius* and *proprius*, an essentiality, which as Pair and Opposite is radically gendered.

AN OLDOWAN ORIENTATIO

It is because of man's vertical posture that space is organized in a structure inaccessible to the prehominiens: in four horizontal directions radiating from an "up"- "down" central axis. . . . It is from this original and originating experience — feeling oneself "thrown" into the middle of an apparently limitless, unknown, and threatening extension — that the different methods of *orientatio* are developed. . . . and their cosmological symbolism.

(Eliade, *A History of Religious Ideas*: 1:3)

The *prima materia* of core and flake implies two sides of something, two sides of a pair of things that fit together, a left and right, something in the left hand, something in the right. In turn, hammerstone and anvil imply the notions of the "above" and the "below." Left and right and above and below generate an orientation in the world, an openness of space, a spaciousness within a spaciousness. Left and right and above and below generate a mesocosm, itself between the unbounded, limitless, world of the macrocosm and the incipient microcosm of the world within the individual. The mystery of stone reflects and organizes two great mysteries — the mystery of life in this world surrounded by the great sleep of the unknown, and the mystery of the energies and forces within the individual, contained and unbounded.

Further, hammerstone, core, flake, and anvil represent a space of orientation organized from out of the bipedal, vertical posture of the Oldowan protohumans. The core/flake technology thus implicitly subsumes the preparatory stage of evolution, the Australopithecine stage, thematized as Uprightness and the Consort Pair. This space of the four — of the above, the below, and the two sides between — is an orientation, a place of uprightness, of standing in and opening toward, the wide open mystery of life.

Thus, an artifact like FxJj1 #302 incarnates an original and originating intuition of the sacred — it reverberates like a chill up and down the spine. This artifact with a rhomboid between fourfold flakes expresses and evokes a quadruple orientation, opening toward: (a) the four directions of the lived world, (b) the ritually created world, a sacred space, enacted and signified by a non-utilitarian, curated artifact, such as #302, (c) the vastness of the starry macrocosm, the world beyond, and (d) the microcosm within, the realm of inwardness, of self-becoming, itself constituted by a fourfoldness of polar energies. This microcosm, which has been given uncountable names throughout the prehistory and history of human psychology, such as superego, ego, soul, and id.

THE FIRST METAPHOR

Warm intimacy is the root of all images. . . .

(Bachelard, *The Poetics of Space*: 154)

In inventing the first tools to make tools, protohumans invented the first metaphor. From the ancestral substance of the between — nuts, seeds, tubers, and possibly bones, which were broken open to yield their inward,

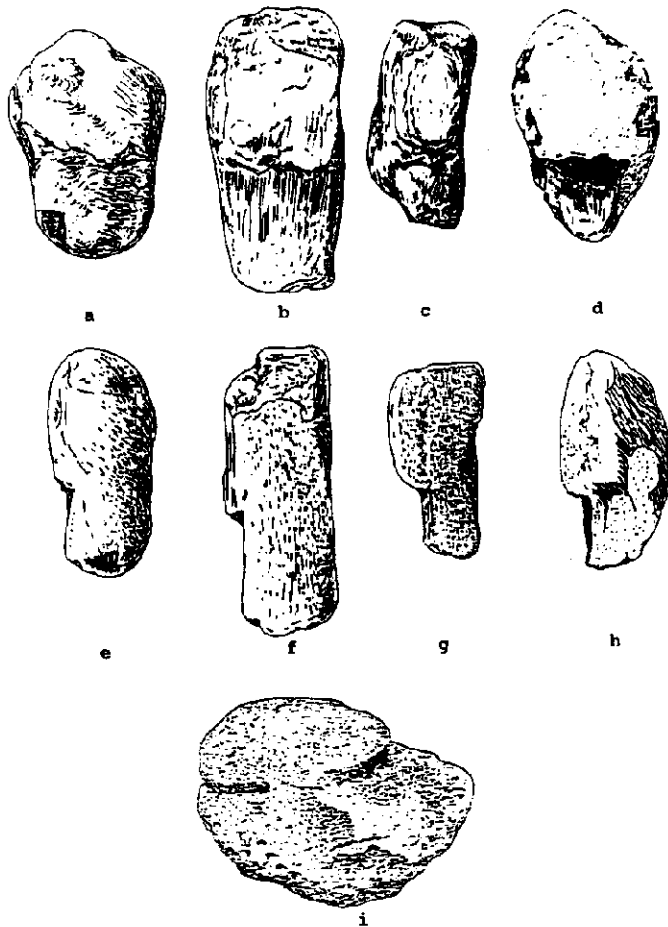


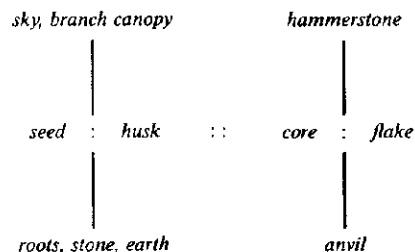
Figure 5. (a, b, c, d) top view, baboon heads; (e, f, g, h) side view of same, Ohle Pit, Great Pampau, Germany, 0.5 MYA or earlier, 1/3 actual size (drawing J. E. Musch); (i) grooved and pecked phonolite cobble, FLK North 1, Olduvai Gorge, 1.8 MYA, 3/4 actual size (drawing J.E. Musch after photo M. Leakey).

core sustenance — the use of hammerstone and anvil are transferred to a new substance of the between: the *prima materia* of stone. In this transference, the first metaphor comes to be, and the realm of the “as if” reveals itself for the first time to the human mind. The stone pebble or cobble is like a nut, seed, or bone. This metaphor — “the seed-like stone” — generates a series of implicit metaphors. The cortex of the stone pebble — and, in a sense, the flake — is its shell, husk, pod, or bone; the inner core, its nutmeat, seed, marrow. The act of flaking the stone is the act of peeling or paring away or breaking open the stone to get at its nutritious core. The metaphor plays on the dialectic of core and flake, cortex and *prima materia* (matrix, continuum, whole).

If we accept the fourfold dialectical cognitive capacities of the Oldowan mind, and its grasp of “the original *prima materia*,” as described earlier, then there seems no reason to assume that the Oldowan mind was incapable of grasping this first of human metaphors and its manifold of metaphoric reverberations. In metaphorical comprehension, the mind, at the basic level, relates dialectical notions (ideas, oppositions, differences), while, at a higher level, relating relations via analogy and similarity, and, at a still higher level, establishing a metaphoric network, which has cross-reverberations between sets of relations of relations.

The Oldowan mind grasped in the flake/core the dialectical concepts of the pair and of opposites, of nearbyness and separation. It imagined the dialectical relationships of parings and core, source and surface, inside and outside, bounded and boundless. It saw the essence of essences, the *prius*. It feelingly grasped the social nexus of affinity, reconciliation, competition, and conflict. At the higher level of relations of relations (that is, similarity, analogy), it could grasp the idea of a *prima materia* as a region of pure similitude or likeness, that is, a continuum or matrix “within which” dialectical differentiations, the opposites, are held and graspable. At this level a set of thematic (proto-mathematic) mental operations is evident, such as complementarity (logic of whole/part), pair, alternative, opposite side, and uprightness (a proto-topology), which operate upon the blank continuum.

This structures the analogical metaphor of stone:

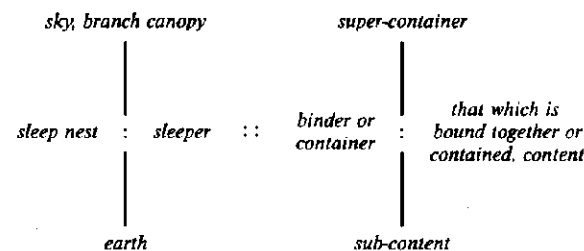


— the central analogy of which can be read: “seed” is to “husk” as “core” is to “flake.” These relationships structure a competence for generating similes, such as a stone core is like a seed and a flake is like a seed husk.

Further, this “primordial philosophy,” or “first philosophy,” tells us that the *prima materia* of stone is both source (origin, *arché, origo naturalis*) and a work, a thing made (*opera, opus contra naturum, a telos, a final cause*).

The analogical metaphor of the stone tool manifests itself in the dialectic of tool function. A chopper core is a core to get at a core, e.g., a chopper to break open a bone to get at the marrow; a chopper to crush open nuts, seeds, tubers. (Again, the theme of tool to make a tool, of the reduplication, the meta-tool, the meta-physical, appears.) Conversely, a core scraper is a core to get at a “flake,” i.e., to scrape a hide, the “flake” or “cortex” of a carcass. A waste core is a spent core. A utilized flake is a flake to get at a core, e.g., to cut through a hide to get at the meat inside; to scrape bark or wood away to the pith or to a sharp point. It is a flake to get into the inside of things. It may be a flake to get at a flake, e.g., a flake used to cut bark for a container or to cut brush for a windbreak. A flake scraper is also a flake to get at a flake, that is, to separate off the hide, the “flake” of the carcass’s “core.”

If one may infer the existence in the Oldowan of a technology of containers and binders, this technology may be similarly analyzed as a transference giving rise to a fundamental metaphoric structure. In this case, the structuring analogy would be:



— the central analogy of which can be read: “sleep nest” (such as chimpanzees make) is to “sleeper” (the single or pair who sleep in the nest) as “container or binder which holds together” is to “the contained, the content, or that which is bound together.” Containers imply containers within containers, for example, a fibre bag or thong stored in a windbreak or hut, a content within a content, and so on. A technology of containers and binders requires the thematic (proto-mathematic) operators greater than/less than and concentricity; it implies notions such as the miniature or the stereotypical copy; and of centeredness, a gathering or collection, a set. It provides a competence to generate similes about the macrocosm, the great container of all things, and the microcosm, the world within; or, this lived world, and the world beyond; or, a ritualized, sacred space, which is reduplication and intensification of the lived world; in other words, all sorts of worlds within worlds, and dreams within dreams.

Here we enter that region of the imagination so eloquently described by Gaston Bachelard in *The Poetics of Space*, especially the chapters on

the nest and on the miniature. In the former he observes: "In its germinal form . . . all of life is well-being. Being starts with well-being. When a philosopher considers a nest, he calms himself by meditating on the subject of his own being in the calm world being." In the latter he describes the "oneiric," the "warm intimacy which is the root of all images," and the feeling of at-homeness in a miniature world, which separates one from dissolution in the vastness of the surrounding world. The stone technology and container technology set up a double set of metaphors that cross reverberate, and which provide a competence for generating even more sophisticated similes. For example, the all-sustaining seed core is the world deep within us; or, the vastness of the world, the macrocosm, which overwhelms us, yet is a source, a higher source, which holds us, as in a dream, and nourishes us. An almost endless series of similes resonate among the sixteen nodes of the stone-tool and container metaphors.

In this metaphoric network, the *prima materia* of stone takes on the connotation of potentiality and of life itself. The stone pebble is a protective surface containing an inner core, which seed-like, contains the potentiality of life itself, the source of life, the seeds of potentiality, the seed of life. The *prima materia*, the pebble, is flaked like a bone to be broken open for marrow, the nourishing core, the inward source of blood, which is — we may assume for the Oldowan mind, as for later cultures — the source of life for human beings. In short, a source of life resides within it; for the Oldowan hominids a stone is alive. In flaking a stone, the stone worker finds the life within it. Fittingly, the primordial substance is frequently a water worn pebble or cobble, rounded and egg-like. The *prima materia* contains or is an egg-like potentiality for that which is born out of it, core and flake, the instruments of survival, of life.

In sum, the Oldowan technology, arising from something "good to eat," offers the mind something "good to think," "good to imagine," and "good to grasp intuitively and affectively." It opens up a revelation of humanity's place in the cosmos, and of the source and the work *par excellence*: the *prius* and the *proprius*, which is, first and foremost, for its own sake. The Koobi Fora bifacial chopper, FxJj1 #302, resonates in this metaphoric network. It substantializes and crystallizes its fourfold shape, it centers us, in an oneiric reverie, an intimate warmth, which is the centering of the core in and for itself, seed of its potentiality, self-sustenance, and self-becoming.

A WORD BEFORE THERE WAS A WORD: THE FIRST CYPHER

The symbol or cypher opens us up for Being. . . . It is communication, a contact between soul and Being. . . . It is inexhaustible signification.

(Jaspers, *Truth and Symbol*: 39–42)

Based on tool technology, Wynn as well as Alexander infer that the Oldowan hominids had some sort of semiotic capacity. By analogy to the Piagetian developmental stages, if the Oldowan hominids had pre-operational intelligence, they likely possessed the semiotic capacity that

precedes and underlies such intelligence. This capacity includes the interiorization of action schemes in representations; deferred imitation; symbolic play; the first mental images as internal imitations of actual, anticipated, or fantasized external actions or communicative gestures; and verbal evocation of absent things or events not present.

Research by Lieberman and others on the evolution of language suggests that the capacity to produce fully articulate speech may have evolved in the last 300,000 years, with *Homo sapiens*, although, as Marshack observes, the actual development of speech may not have come until the Middle or Upper Paleolithic.

Falk's analysis of a skull from Koobi Fora, classed as *Homo habilis* and dated at least 1.88 million years ago, indicates that it has a "human-like" development in the frontal lobe area associated with the Broca area, and that, in consequence, was probably capable of some sort of speech. Broca's area 44 of the left frontal lobe in modern humans controls the production of language, especially the grammatical and syntactic functions. This research suggests that the Oldowan mind had evolved beyond pongid-like gesture and call communication and involved something like syntactic or combinatory symbolic behavior. Such syntactic, combinatory behavior would fit well with the reconstruction of Oldowan mental capacities and metaphoric competence described in the preceding argument, including such cognitive pre-operations as "nearbyness and separation," and the order relations "pair" and "opposite sides."

If so, what were the first Oldowan communicative symbols? Since most any aspect of survival could be expressed naturally through pongid style communication (call, posture, gesture, facial expression), that would leave the one "new" thing that could not be so expressed, namely the cognitive competence of the Oldowan mind, with its various elemental notions and metaphoric possibilities. And the public, shareable representation which could be used to express these possibilities was precisely that which gave rise to them in the first place, the technology of stone and of containers. These constituted the first symbols and the first "language."

Core/flake, as that which "fit together," was the first *symbolon*. Core and flake imply the very notion of "symbol" itself, since the root word for symbol, *symbolon*, means precisely that which is thrown together, or fits together, as a seal or indication, that something is whole, fully present, fully possessed — a something, which, of course, is, as *prima materia*, fully absent, somewhere in the between of the either/or, the space for taking a stand, for breathing, the opening for new life, the potentiality for the requisite or indispensable action.

Core and flake were dialectical operators which in an external, public, or ritual space could "represent," "enact in symbol," or "reproduce" particular messages. For instance, a given combination of core(s) and/or flake(s) could symbolize an endless series of activities or enactments, such as "the pair, a consort relationship"; "alternating sides, which belong together"; "core inwardness"; "the heart-soul"; "this world and the beyond"; "what is essential," "that which is, and is for its own sake," "a gift of beauty," a "reconciling and healing affinity," "that which is excellent or outstanding";

"the invisible bonds which hold us, and all things, together." Core and flake could symbolize the splitting of the primal egg, through which we evolve, the omega; hammerstone and anvil, spheroid and baboon head symbolize the prior, the alpha, that from which we have evolved. The pyramidal forms could symbolize the dazzling geometry of the heart of inwardness; the rhomboids, pairs of pairs, the pair *par excellence*, the consort pair, the diamond love which transcends the stasis of mere survival and the stasis of hierarchical power, and which is the motive force of evolution.

"Core/flake," "hide/sinew" — these symbols are transparent to mind and to psyche, to ego and to soul, to that which is distinctively human. These are the first cyphers not of "being" but of "what it means to be human." Ontology is most primordially ousiology — what brings the individual into its own, into the self-possession of what it means to be human, coming into its own, in its gendered radicality, which, thereby, is radically open, between, in relationship, in consortship. Pointed scrapers, pyramids, rhomboids, FxJl #302, these speak worlds, worlds of the human heart. They are the word before language, the cypher before codes, the mark before signs, the icon before iconography. They are the myth before myth. They are the first symbols.

They communicate the potentiality — the *prima materia* — at the heart of our lives. They communicate the slash that is between them, the voiceless surd, the either/or, the fork in the path, the competition and the separation through which we pass toward healing. They speak of that from which we have evolved — and our roots — the baboon... and the pure spheroid hammerstone of the spirit. They speak of that through which — toward which? — we evolve, the labor to engender the Pair, the Pair which is for its own sake, which is at the core, the heart-soul of our communion and of our ownmost life.

Splitting, paring, the primordial egg-like stone, "the human" — what it means to be human — engender that out of which we evolve, our *prius*, our essential relationship. This is an incipient religion, for does not "religion" mean "a binding back," and does not every religion represent in its symbolism the stage out of which it came, as well as that stage through which we are evolving?

This is the great evolutionary leap, the great transformation.

THE INVENTION OF SOUL

By a tiny tangential increase, the radial was turned back on itself and so to speak took an infinite leap forward. Outwardly, almost nothing in the organs had changed. But in depth, a great revolution had taken place: consciousness was now leaping and boiling in a space of super-sensory relationships. ... With hominization, in spite of the insignificance of the anatomical leap, we have the beginning of a new age. The earth ... finds its soul.

(Teilhard de Chardin, *The Phenomenon of Man*: 168–69, 182)

An Oldowan apperception of the soul is implicit in the Oldowan stone-tool technology. It is implicit in the "first metaphor" and the "ontology of stone," that is, as the *prima materia*, as the pyramid or rhomboid form

which is appreciated in itself and for its own sake, and as the portable core, which moves with one as one moves through this world and which is sustenance to one's life. An apperception of soul is implicit in an artifact such as FxJl #302, as a centering of the crystal-like essence in the core of itself, as something for the sake of itself emerging serendipitously out of the core of itself.

If the Oldowan mind possesses a pre-operational intelligence and proto-semiotic competence, then, by the same inferential approach, one may posit an Oldowan apperception of the soul (psyche). The maturation of cognitive pre-operations corresponds psychologically to the maturation of juvenile personality features, paramount among them being, according to Sullivan, the need for a compeer, a friend as like oneself as possible, a "friend just like me." For the isolated child, this may be an imaginary friend "just like me." The latter stands in contrast to the fantastical, imaginary friends of young children. Additional juvenile characteristics noted by Sullivan and Piaget include a concern for self-esteem, self-hurt, and self-respect; the appearance of a psychic supervisor, a spectator on one's actions, a hearer of one's communications, who plays a role in maintaining one's feelings of personal self-worth and in gaining the respect of others; a sort of semi-reversible, semi-monologue style of discourse; and a sense of interpersonal rules as given by an inviolable higher power and the dynamics of submission and violation. This stage culminates with the lessening of the effects of the superego and authority in favor of feelings of justice and other aspects of moral or affective reciprocity which mature in the subsequent stage of concrete operations.

By analogy, then, the Oldowan personality contained an apperception of the soul as the imaginary friend within, "a friend just like me," a sort of twin of the ego. In such an apperception, ego and soul could communicate with each other through a pre-symbolic call, gesture, facial expression, or posture, or through the various Oldowan symbols, real or imaginary. If this communication process is semi-reversible, then it will frequently be a unilateral communication, a command or declaration, from the soul, or from the ego. As semi-reversible the soul is both "like" the ego, and yet something very other in status, perhaps even the ultimate source of self-worth. This soul component is distinguishable from the supervisory ideal, the monitor or spectator who affirms or, more frequently, disconfirms one's actions and esteem. Besides these three components of the psyche, a fourth would be the body itself and its vital drives and emotions, i.e., "the unconscious."

Primate research by Goodall and Smuts indicates that baboons and chimpanzees are adept at deception, lies, and the inhibition and displacement of sexual and aggressive drives. When a subordinate chimpanzee's goal-directed activity is interfered with by a dominant chimpanzee, the former can divert the latter's attention. This often occurs when the subordinate wants to get something that belongs to the superior. A chimp may covertly steal food from another while overtly grooming him. Or wait until the other is asleep, or looking away. If baboons and chimps engage in deception, lies, and inhibition of expressions of emotion, especially with

respect to expressions of the desire for food or sex or aggression and in contexts of fear (domination by ranking males, enemies), there is no reason to assume that they do not have a superego and a personal unconscious in their psychic structure, and, it is even more likely, that the Oldowan hominids also had such personality components.

All four components constitute a dynamic system, the Oldowan dialectic of the personality, and the Oldowan hominids had the mental tools to grasp them. Ego and soul or ego and body may be conceived of as "the pair" or "the opposite sides" — an opposite which other than being opposite is a chip off the same block, much like the ego. The soul is like the "core" of the self; the ego-ideal, like a hammerstone; and the body, like an anvil, rooted in the earth, unseen, unconscious. The Oldowan hominids were the first to experience possession of "core inwardness" or "heart-soul" as an invisible communicator within and a "friend just like me."

THE NICHE OF ORIGINAL METAPHOR

The entire network of Oldowan concepts and metaphors, the ontology of stone, the heart-soul, all this is implicit in the great transfer, the grand translation, of hammerstone and anvil from nutcracking to stonecracking. This was the great evolutionary "leap," a leap that was simultaneously a leap into the savannah gathering-scavenging niche and into the niche of the mind-psyche.

By inventing the core/flake technology — and, most likely, the hide/sinew technology — the Oldowan mind gained a mental instrument for grasping fundamental aspects of experience, of the lived world as well as of the psyche itself. Through a transformation of stone the Oldowan hominid gained a revelation of dialectical processes informing the macrocosmos of nature and the microcosmos of the psyche. Each of these mysteries could now be illumined as dialectical "to the core." By inventing the core/flake technology, the Oldowan hominids invented a mnemonic device, a way of storing information about the great dialectical processes of life, and the heart of evolution itself. They found a way of communicating information about that which is first and foremost, the supremely essential thing about living. They found a way of memorializing it in stone.

LITHI-STRATA, OR TOOLS AND THE GENDER QUESTION

A genuine reflection on the distinctively human qualities of Oldowan stone technology entails the question: how is this adaptation gendered? In a series of studies over the last decade, the popular view that the invention and use of tools to make tools was a male affair has been shown to be untenable. McGrew observes that among chimpanzees it is females that most frequently use tools in the acquisition of food. This holds for each of three basic types of tool-use: probes for obtaining termites, ants, or honey; stones as hammers to smash open tough-skinned fruits; and leaf sponges to soak up water. Female chimpanzees fish for termites three times

as frequently as males, whether this is measured in terms of frequency or cumulative duration of bouts of fishing. Males predominate in the use of weapons, typically unmodified sticks, branches, or stone missiles.

Research on chimpanzees in the wild by Boesch and Boesch has revealed that it is almost exclusively females that use natural hammers to open Coula nuts in the tree and crack open the hard Panda nuts. Both techniques are difficult and imply either anticipating the need of a hammer and its transport, or exact position of the nut and precise dosage of hits. In the instance where both sexes use the hammer technique — cracking Coula nuts on the ground — the efficiency of females is superior to that of males. The more advanced nature of technology among females is possibly attributable to several factors. Males have more difficulty in controlling their emotions when using a tool to open nuts, since stones and clubs are sometimes part of their threat displays and aggression, with negative consequences for motor control. Males lack concentration, and thus interest in this activity. Males are more attentive to social stimuli and use techniques performed in groups, and hence on the ground. Conversely, female subadults are more motivated than subadult males to observe and learn the nut-cracking behavior, and, therefore, master the technique more quickly and efficiently. Finally, female mothers take an active part in the apprenticeship of their female offspring by either rewarding their attention with nuts or affection or by supplying them with tools.

Zihlman places female protohumans as leaders of the new adaptation to the savannah niche. Hominids were on the scene well over a million years prior to the appearance of stone tools. Given chimpanzee tool-use, a long period of hominid organic tool-using may have preceded the invention of flaked stone tools. The digging stick or similar such tools may have been invented during this stage. Gathering and preparing food with tools made it possible for early hominids, especially mothers, to exploit the abundant savannah resources. Implements to contain and transport collected food stuffs were a part of this adaptation. Tools invented for food preparation, to pound and pulverize tough plant foods or to cut up large fruits and vegetables for consumption and sharing, could have provided a basis for inventing stone tools for cutting up animal carcasses.

Turning to recent gatherer-hunter societies, females seem to have a special role in making and using Oldowan-type technologies. Australian aboriginal women make flake and core tools, and use sharp flakes for butchering and other domestic tasks; Tiwi women made axes. Kung San women carry a stone chopper to sharpen their digging sticks, and chopper tools are similarly used by Australian aboriginals, whose technology is largely based upon organic tools manufactured with stone tools. Shoshone women were the makers of chopper tools, which they made for their own use.

In sum, research on chimpanzees and recent gatherer-hunter societies strengthens the likelihood of Zihlman's hypothesis that females played the predominate role in the invention, and even in the use, of the Oldowan stone-tool industry. If so, they would have played a predominant role in the invention of the Oldowan mind and psyche, and in the invention of the first metaphor, the ontology of stone, the first symbols, and the first art.

REFERENCES

- Alexander, R. 1989. Evolution of the human psyche. In P. Mellars and C. Stringer, eds., *The Human Revolution: Behavioral and Biological Perspectives on the Origins of Modern Humans*, 455-513. Princeton, N.J.: Princeton University Press.
- Bachelard, G. 1964. *The Poetics of Space*. New York: The Orion Press.
- Benekendorff, U., and J. E. Musch. 1990. From the information recorder "stone," to a picture book of the stone age. *Archaeologische Berichten* 20:14-65. Elst, NL: Archaeologische Berichten Foundation.
- Blumenschine, R. 1987. Characteristics of an early hominid scavenging niche. *Current Anthropology* 28, 4:383-407.
- Boesch, C., and H. Boesch. 1981. Sex differences in the use of natural hammers by wild chimpanzees. *Journal of Human Evolution* 10:585-93.
- Bunn, H. 1981. Archaeological evidence for meat-eating by Plio-Pleistocene hominids from Koobi Fora and Olduvai Gorge. *Nature* 291:547-77.
- . 1983. Evidence on the diet and subsistence patterns of Plio-Pleistocene hominids at Koobi Fora, Kenya, and Olduvai Gorge, Tanzania. In J. Clutton-Brock and C. Grigson, eds., *Animals and Archaeology: I. Hunters and Their Prey*. BAR International Series 163:21-30.
- Bunn, H. T. 1983. Comparative analysis of modern bone assemblages from a San hunter-gatherer camp in the Kalahari desert, Botswana, and from a spotted hyena den near Nairobi, Kenya. In J. Clutton-Brock and C. Grigson, eds., *Animals and Archaeology: I. Hunters and Their Prey*. BAR International Series 163:143-48.
- Bunn, H., and E. Kroll. 1986. Systematic butchery by Plio/Pleistocene hominids at Olduvai Gorge, Tanzania. *Current Anthropology* 27, 5 (December 1986): 431-52.
- Coon, C. S. 1976. *The Hunting Peoples*. New York: Penguin Books.
- Dart, R. 1974. The waterworn Australopithecine pebble of many faces from Makapansgat. *South African Journal of Science* 70:167-69.
- Derrida, J. 1981. *Dissemination*. Chicago: University of Chicago Press.
- Eliade, Mircea. 1978. *A History of Religious Ideas*. Volume 1: *From the Stone Age to the Eleusinian Mysteries*. Chicago: University of Chicago Press.
- Falk, Dean. 1983. Cerebral cortices of East African early hominids. *Science* 221:1072-74.
- Foley, R. 1984. Early man and the red queen: tropical African community evolution and hominid adaptation. In R. Foley, ed., *Hominid Evolution and Community Ecology*, 85-110. New York: Academic Press.
- . 1987. Hominid species and stone-tool assemblages: how are they related? *Antiquity* 61:380-92.
- Gero, J. 1991. Genderlithics: women's roles in stone tool production. In J. Gero and M. Conkey, eds., *Engendering Archaeology: Women and Prehistory*, 163-93. Cambridge, Mass.: Basil Blackwell.
- Goodall, J. 1986. *The Chimpanzees of Gombe: Patterns of Behavior*. Cambridge, Mass.: Harvard University Press.
- Gowlett, J. 1984. Mental abilities of early man: a look at some hard evidence. In R. Foley, ed., *Hominid Evolution and Community Ecology*, 167-92. New York: Academic Press.
- Isaac, G. 1976. Plio-Pleistocene artifact assemblages from East Rudolf, Kenya. In Y. Coppens, F. C. Howell, G. Isaac, and R. Leakey, eds., *Earliest Man and Environments in the Lake Rudolf Basin: Stratigraphy, Palaeoecology, Evolution*, 553-63. Chicago: University of Chicago Press.
- Jaspers, K. 1959. *Truth and Symbol*. New Haven, Conn.: College and University Press.
- Keeley, L., and N. Toth. 1981. Microwear polishes on early stone tools from Koobi Fora, Kenya. *Nature* 293 (October 8, 1981): 464-65.
- Leakey, M. D. 1971. *Olduvai Gorge*. Volume 3: *Excavations in Beds I and II, 1960-1963*. Cambridge: At the University Press.
- . 1976. A summary and discussion of the archaeological evidence from Bed I and Bed II, Olduvai Gorge, Tanzania. In G. Isaac and E. McCown, eds., *Human Origins: Louis Leakey and the East African Evidence*, 431-59. New York: W. A. Benjamin.
- Lieberman, Philip. 1975. *On the Origins of Language*. New York: Macmillan.
- McGrew, W. 1981. The female chimpanzee as a human evolutionary prototype. In Frances Dahlberg, ed., *Woman the Gatherer*, 34-73. New Haven, Conn.: Yale University Press.
- Marshack, Alexander. 1976. Some implications of the Paleolithic symbolic evidence for the origin of language. In S. R. Harnad, H. D. Steklis, and J. Lancaster, eds., *Origins and Evolution of Language and Speech*, Annals Volume 280, 289-311. New York: The New York Academy of Sciences.
- Piaget, J. 1973. *The Child and Reality: Problems in Genetic Psychology*. New York: Grossman Publishers.
- Potts, R. 1983. Foraging for faunal resources by early hominids at Olduvai, Gorge, Tanzania. In J. Clutton-Brock and C. Grigson, eds., *Animals and Archaeology: I. Hunters and Their Prey*. BAR International Series 163:51-62.
- . 1984. Hominid hunters? problems of identifying the earliest hunter/gatherers. In R. Foley, ed., *Hominid Evolution and Community Ecology*, 129-66. New York: Academic Press.
- Potts, R., and P. Shipman. 1981. Cutmarks made by stone tools on bones from Olduvai Gorge, Tanzania. *Nature* 291:577-80.
- Ruland, M. 1964. *A Lexicon of Alchemy*. Translated by A. E. Waite. London: John M. Watkins.
- Shipman, P. 1984. Scavenger hunt. *Natural History* 4:20-27.
- Shipman, P., W. Bosler, and K. Davis. 1981. Butchering of Giant Geladas at an Acheulian site. *Current Anthropology* 22, 3:257-68.
- Smuts, B. 1987. What are friends for? *Natural History* 2:36-45.
- Sullivan, H. S. 1953. *The Interpersonal Theory of Psychiatry*. New York: W. W. Norton and Company.
- Teilhard de Chardin, P. 1959. *The Phenomenon of Man*. New York: Harper and Row.
- Toth, N. 1985. The Oldowan reassessed: a close look at early stone artifacts. *Journal of Archaeological Science* 12:101-20.
- Van Es, J., and C. Franssen. 1989. Een Vroege Microkern-Traditie van de Peelhorst het Boukoulien. *Archaeologische Berichten* 19:6-38.
- Wouters, A., C. Franssen, and A. Kessels. 1981. Typologie van de artefacten van de Chopper-Choppingtool Complexen. *Archaeologische Berichten* 10:18-117.
- Wynn, T. 1979. The intelligence of later acheulian hominids. *Man* 14:371-91.
- . 1981. The intelligence of Oldowan hominids. *Journal of Human Evolution* 10:529-41.
- . 1985. Piaget, stone tools and the evolution of human intelligence. *World Archaeology* 17, 1:32-43.
- Zihlman, A. 1981. Women as shapers of the human adaptation. In Frances Dahlberg, ed., *Woman the Gatherer*, 75-120. New Haven, Conn.: Yale University Press.