

## CHAPTER

### The Early Work of Alexander Marshack

#### 1. Introduction

Alexander Marshack was born in April, 1918 in the Bronx. He attended high school in the borough and received a bachelor's degree in journalism from the City College of New York in 1943. He was rejected for military service that same year owing to severe allergies but served as director of publicity for the Red Cross in the mid-Atlantic area. After the war he continued his life as a journalist, branching out into radio- and later television-production and writing. He was also a skilled photographer and for several years worked for Life magazine. In 1958 he was commissioned to write a book on the International Geophysical Year (IGY).<sup>1</sup> A few years later during the summer of 1962, with the Soviet and American space programs well under way, he was asked to write a book with Robert Jastrow, then director of the Goddard Space Flight Center, for NASA. It was to deal with how human beings had come to the point of space exploration, including a projected moon expedition, and the technical problems involved with a lunar landing.

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<sup>1</sup> Alexander Marshack, The World in Space: The Story of the International Geophysical Year (New York, Thomas Nelson and Sons, 1958). Details of Marshack's life can be found in several obituaries and a New Yorker profile. See Paul G. Bahn, "Alexander Marshack: 1918-2004," Antiquity 79, (2005), 489; The Sunday Times, 22 January, 2005; Jennifer Bayot, "Alexander Marshack, 86, Dead: Studied Stone Age Innovations," The New York Times, 28 December, 2004; Calvin Tomkins, "A Reporter at Large: Thinking in Time," The New Yorker, (22 April, 1974) 114-28.

Marshack's specific task was to provide the historical and scientific context for space exploration. In 1963, he started on a lengthy research program, including hundreds of interviews with scientists and military and civilian experts involved with both the American and the Soviet space programs. For two reasons it turned out to be "an almost impossible task."<sup>2</sup> First, among all the persons he spoke with, "not one person I met knew clearly why we were going into space or how it had come about." The vast teams of specialists knew only their specialties; no one had thought about the big picture. As Marshack understood his task, however, it was to see why the space program was begun, why it had been a success, and what it all meant. In consequence, after a year of effort, Marshack concluded he could only "report the scene, capture a few of the personalities, explain the science, problems and plans and give some of the fragmented historical record." That is, the fragmentary nature of the materials meant that a coherent and non-fictional narrative simply could not be written.

His second problem was more interesting. At one point he had to write a few paragraphs on the "apparent beginnings of mathematics, astronomy, and science." This task proved even more difficult for many of the same reasons: "there were not enough facts." Looking at the available accounts of the beginnings of mathematics,

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<sup>2</sup> See his account in The Roots of Civilization: The Cognitive Beginnings of Man's First Art, Symbol, and Notation, (New York, McGraw Hill, 1972), 10ff.

astronomy and so on, “I was appalled at what seemed the inadequacy of the record.” Marshack described his experience as one of frustration. He knew that something was missing from the historical and prehistorical record, but he didn’t know what and so didn’t know what to look for. When he tried to account for why he thought “something” was missing, he recalled his own experience as a well-travelled journalist, photographer, and author. From reflecting on his own experience, that is, Marshack contextualized the space program within a range of other human activities: from the contemporary lives of persons living in the New Guinea jungle and starving farmers in India, to the much earlier lives of European mammoth-hunters or of persons who “had painted the caves of Ice Age Europe.”

Looking at the archaeological evidence, Marshack drew the obvious conclusion regarding brain size and skeletal morphology. Had his reading been in the area of philosophical anthropology rather than social and paleoanthropology he might have reflected on the relative constancy of human nature. In the event, he gained a heightened sense “of the inadequacy in the traditional image of prehistoric man and his culture.” He also sensed that the traditional accounts of how mathematics and astronomy “suddenly” appeared with the Babylonians or Greeks or Chinese was unlikely.<sup>3</sup> Marshack was sufficiently reflective to note that his

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<sup>3</sup> The problem Marshack had discovered is equivalent to one discussed, in the language of philosophical anthropology and political science, as the differentiation of consciousness. See Cooper, Consciousness and Politics: From Analysis to Meditation in the late Work of Eric Voegelin, (Notre Dame, St. Augustine’s Press, 2016).

uneasiness stemmed precisely from his being an outsider to the established archaeological discourse. None of these achievements –art, agriculture, mathematics, writing, calendars, urbanization, and so on—could have happened suddenly. “They must have come at the end of many thousands of years of prior preparation. How many thousands was the question.” This was an insight that came to him on the basis of his work on the IGY when he discovered that contemporary scientists were preceded by generations of earlier work about which they knew little and often were entirely ignorant. He suspected that the same problem existed in the reality of prehistory and was reflected in the archaeological accounts of it.

When he was writing his book on the IGY, Marshack said he was “struck” by the thought that all of the programs that he had discussed were “time-factored,” including the Geophysical Year itself, which was timed to coincide with an eleven-year cycle of maximum sun-spot activity. We discuss the significance of this concept, time-factoring, toward the end of this section. When he first hit upon the term, Marshack noted that a time-factored process in the natural sciences, was “almost tautological” because “all processes,” whether “simple or complex, sequential or interrelated, finite or infinite, develop or continue and have measurable rates, velocities, durations, periodicities and so on.” Moreover, sciences that study these processes are themselves time-factored because the

processes of cognition, research, analysis, interpretation, and so on are also simple or complex, sequential or unrelated, developmental or cumulative. The same is obviously true in the historical sciences as well, with the difference that, in philosophical anthropology, the various historical symbolizations of the historically transcendent, eternal, infinite, and so on also have to be considered.

In the spring of 1962 Marshack visited Ralph Solecki, an archaeologist, in his office at Columbia University, to discuss the problem he was having writing the few paragraphs on the origins of mathematics and astronomy. Solecki had excavated Shanidar cave in Iran, which had successively been inhabited by Neanderthals and Sapiens. Marshack wondered what skills the Sapiens had developed in terms of village-building and agriculture that conditioned the “transition” between the two kinds of humans.

Agriculture, Marshack said, is more intensely time-factored than hunting in that it required continuous awareness and monitoring of the seasons whereas hunting did not. Or, even if seasonal migrations of game were important, they were not as important as, say, was the date of the annual flooding of the Nile for deciding when to begin agricultural planting. Marshack then asked Solecki: where did these enhanced time-factored skills come from? What was the archaeological evidence for them? “Solecki laughed, and said that I was asking questions that archaeologists had not yet dared to ask.” Most archaeologists were concerned with

establishing chronology and cataloguing the material record, which at the time was understood as a series of static cross-sections, not a source of time-factored information.

Solecki suggested that Marshack discuss the problem with André Leroi-Gourhan of the Musée de l'Homme in Paris, and Marshack wrote him a letter asking whether, in Leroi-Gourhan's view, any of the cave art was seasonal, periodic, or "time-factored." The French scholar replied, indicating that, in his view, the imagery did have a seasonal significance and was therefore related somehow to the allegedly "sudden" invention of calendars in the Ancient Near Eastern agricultural empires, but also that there was no hard evidence for it.

In April, 1963 Marshack returned once again to the troublesome paragraph on the beginnings of science in the Ancient Near East. This time he looked at the article he had clipped from Scientific American about a year earlier.<sup>4</sup> The author, Jean De Heinzelin, had undertaken a conventional excavation at a previously discovered site at Ishango, in what was then the Belgian Congo. This was a Mesolithic site (ca. 6500KYA) on Lake Edward, near the headwaters of the White Nile. De Heinzelin catalogued the artifacts he uncovered, mostly bone spear and harpoon points and stone tools, and mapped a trade route that diffused the bone

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<sup>4</sup> Jean De Heinzelin, "Ishango," Scientific American, 206 (June 1962), 105-116.

pieces across the continent. “The most fascinating and most suggestive of all the artifacts at Ishango is not a harpoon point but a bone tool handle with a small fragment of quartz still fixed in a narrow cavity at its head.” He speculated that it might be an engraving or tattooing implement or possibly used for writing. “Even more interesting, however,” he went on, “are its markings,” which he described and illustrated. “The pattern of these notches leads one to suspect that they represent more than pure decoration.”<sup>5</sup>

Looking at this article in Scientific American, Marshack reported once again that he had a “feeling” that something was missing. How could one “decode” the scratches, which were made two or three thousand years prior to the earliest calendars or hieroglyphics? “I decided to try a hunch, based on ideas suggested by the book I was writing. In fifteen minutes I had ‘cracked the code’ of the Ishango bone.” That was it, what Husserl would call an “Aha Erlebnis.” In light of several of Marshack’s later remarks, it would be hard to overstate the importance of this sudden insight. The experience was not a bolt out to the clear blue sky but rather was a discovery of what he had been looking for, namely a pre-calendar but yet calendric document, that had been hiding in plain sight in the Ishango bone.

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<sup>5</sup> De Heinzelin, “Ishango,” 109-10.

A few years later, recounting the sequence of events to Calvin Tomkins for the New Yorker profile, Marshack recalled that he had been working on the problem of the origin of calendars. He had asked the experts, in this case Egyptologists, about the origin of the calendars they had studied. “And every one of them said approximately the same thing: ‘when we find it [a calendar], it is already developed.’” The Egyptologists agreed that the origin of calendars must be dated thousands of years prior to the existing calendars, which date from 3 to 4KYA. Marshack concluded: “I seemed to have stumbled on a prehistoric beginning –and nobody else was working on it.... Everybody said that the problem was fascinating and the answers should be there, but nobody had ever tried to find them.” Not surprisingly, “I got excited as all hell.”<sup>6</sup>

In The Roots of Civilization, published a decade or so after his initial excitement at “cracking the code” of the Ishango bone, Marshack provided a calmer account of what his rather dramatic formulation actually meant. The scratches, he said, were “notational,” a concept that we examine in more detail below. A notation, he remarked by way of summary, was both a record and it was cumulative. Ex hypothesi Marshack thought it was a celestial and probably a lunar

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<sup>6</sup> Tomkins, “A Reporter at Large,” 117.

record. As he later said to Leon Svirski at Scientific American: “by the nature of the assumptions I had made, I had to test everything against the lunar concept.”<sup>7</sup>

Marshack’s reasoning about a lunar record expressed in the notations was commonsensical enough: diurnal, lunar, seasonal etc. changes were as constant as birth and death, something of which even Homo erectus might have been aware owing to the endowment of an enlarged brain with specialized structures for visual and kinesthetic coordination, memory, and so on. To take a modern example, the North American aboriginal plains populations counted past years by winters, “each winter being known for some event taking place at the time, instead of being numbered as is our custom.”<sup>8</sup> Successive years would be represented on printed charts that served as mnemonic aids.

So far as lunar sequences were concerned, the analyst had to use his or her imagination to see how sequences were observed by the one doing the notation.

One cannot, therefore, “crack the code,” as scientists have cracked the codes of the ancient structured writings of the early civilizations from Egypt, Mesopotamia, Phoenicia, and Crete, or as they cracked the codes of the number and astronomical systems of many of these early civilizations. If one approaches the marks as mnemonic, that is, as a storied notation, it is also impossible to perform analysis, because the references would be not to a periodic, constant pattern but to a random patterning. Fortunately, the engraved bones do indicate a consistent

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<sup>7</sup> Marshack Papers, Peabody Museum Archives, Harvard University, Series 2005.16.1. Marshack to Svirsky, 1 April, 1964. Subsequent citations to Marshack’s correspondence are to this collection and are given by date.

<sup>8</sup> Marshack, Roots, 140. For example, one might speak of the spring of the big flood (not of 2013) or the spring of the big fire (not of 2016) in recent Alberta history.

grouping by “periods” made sequentially and therefore lunar tests can be made on their patterns.<sup>9</sup>

And when you actually do count the “days” between, say, full moons, the arithmetic count will vary. “To the maker of such a notation, the 27 and the 33 [marks, notches, scratches etc.] could easily represent ‘two moons.’”<sup>10</sup> That is, the month is clearly divided into periods (new moon, first quarter, full moon etc.) but they are not of arithmetically equal periods. This was Marshack’s great insight. He called it a “storied notation,” because the story could be checked for accuracy by examining the notations as a reflection of actual and observed lunar changes.

To return to the initial account, Marshack said he diligently tried to disprove his interpretation. He thought about asking Leroi-Gourhan and Solecki about it but “I did not dare.” He then put aside the nearly complete manuscript on the space program and devoted a year to research, chiefly in the New York Public Library, and to writing up his account of the Ishango bone and comparing scratches on it to similar marks found on European artifacts of the Upper Paleolithic. His publisher turned down Marshack’s first manuscript dealing with the Mesolithic and Paleolithic origins of calendars; on reflection Marshack agreed that it was not yet ready for publication.<sup>11</sup> His work, after all, had been based on library research and

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<sup>9</sup> Marshack, Roots, 142-3.

<sup>10</sup> Marshack, Roots, 143.

<sup>11</sup> Marshack apparently was also at work on a book, The Making of Man, for the juvenile books series of Basic Books. It was not published either. See Marshack Papers, Marshack to Arthur Rosenthal, 22 June, 1964.

published photographs and drawings by others, not first-hand examination of actual artifacts. Nor had he shown his interpretation to any specialists so he had no clue whether a scientifically formulated version of his argument existed or, if not, whether his commonsensical one was even remotely plausible to the expert community.

In the late spring of 1964, Marshack spoke with Gerald S. Hawkins at the Smithsonian Observatory, Harvard. Hawkins had recently argued that Stonehenge was among other things an observatory insofar as many of the alignments of the stones were astronomical and calendric.<sup>12</sup> Hawkins checked Marshack's arithmetic, performed some statistical analysis, looked at his astronomical argument, "and said yes, I seemed to be correct in methodology and in at least a portion of the findings. Hawkins suggested Marshack discuss the problem with a leading paleohistorian.

Marshack then phoned Hallam L. Movius, Jr., professor of archaeology at Harvard, who was then in France where he was conducting his long-term excavation of the Abri Pataud near Les Eyzies in the Dordogne.<sup>13</sup> Marshack

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<sup>12</sup> See Hawkins, "Stonehenge Decoded," *Nature* 200, (26 October, 1963), 306-8; "Stonehenge: A Neolithic Computer," *Nature* 202, (27 June, 1964), 1258-61, and the later account by Hawkins and J.B. White, *Stonehenge Decoded* (Garden City, Doubleday, 1965. See also Marshack Papers, Marshack to Hawkins, 24 June, 1964.

<sup>13</sup> Movius (1907-87) was born in Newton MA into a distinguished New England family (he was a cousin of Leverett Saltsonstall, Massachusetts governor and US Senator). He entered Harvard College in 1926 to play football and graduated in 1937 with a PhD in archaeology. He remained at Harvard and the Peabody Museum, apart from wartime service in the USAAF as an intelligence officer. He conducted field work in the Old World from Europe to Burma and Java. He is responsible for the Movius Line (1948) that distinguished the stone tools technologies of

informed Movius: “I think I have solved some of the notations of the Upper Paleolithic.” To which Movius replied, “there are no ‘notations’ in the Upper Paleolithic.” Marshack tried to explain what he meant by “notation” and asked if he might visit Movius to set out his account in detail. Before leaving for Paris on August 4<sup>th</sup>, Marshack contacted Philip Abelson, the editor of Science and explained to him in outline his theory and his plan to consult Movius.<sup>14</sup> A few days later he was in the Dordogne to explain his method and its results. Movius was initially skeptical but by the end of two days’ discussion he concluded that Marshack may have achieved a “breakthrough” of sorts. As he wrote later in the fall, “I was tremendously impressed not only with his results, but also with him and his general attitude; he has a surprisingly profound understanding of the significance of the subject on which he has been conducting his research.”<sup>15</sup>

Movius had also accumulated a great deal of experience in the highly competitive world of American academic archaeology and gave Marshack some advice that turned out to be prescient. He explained that archaeologists did not welcome major new ideas so that a deliberate and incremental strategy was

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Africa, Europe, West and South Asia from those of East and Southeast Asia. He was also one of the first archaeologists to use carbon-14 dating. His multi-volume report on the Abri Pataud is an exhaustive model of scientific archaeology. For details, see Edgar J. Driscoll, “Obituary,” The Boston Sunday Globe, 31 May, 1987, and William White Howells, Hallam I. Movius Jr., 1907-1987, (Cambridge, Harvard University, Peabody Museum, 1988).

<sup>14</sup> Marshack Papers, Marshack to Abelson, 20 July, 1964; 28 July, 1964.

<sup>15</sup> Movius to Mary C. Ritter, 13 November, 1964. Movius Papers, Peabody Museum Archives, Harvard University, Series I, 5.22. Other quotations from Movius’ correspondence are also given by date.

required. Movius explained that “I must proceed both with haste and caution. I must leave France at once, talk to no one, and show no one the manuscript. I must publish as soon as possible to establish priority, but not too much, merely a short introductory paper.” He must then quickly return to Europe and check the European materials first-hand, because, Movius said, the existing photographic evidence and published sketches of archaeological materials were inadequate for the serious scientific work Marshack proposed to undertake.<sup>16</sup> Marshack returned to New York and began writing a short paper outlining his argument.

## 2. Early Formulations

The paper, “Lunar Notations on Upper Paleolithic Remains” appeared in early November in Science.<sup>17</sup> Marshack’s first scientific publication was two-and-one half pages long. He began by noting that Hawkins’ papers on Stonehenge indicated an “unexpectedly complex” understanding of solar and lunar events. The presence of such astronomical skill and knowledge elsewhere in Eurasia, notably in the Near East, raised for Marshack “the question as to whether an earlier, basic

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<sup>16</sup> Marshack, Roots, 16-18.

<sup>17</sup> 146 (6 November, 1964) Abelson accepted it for consideration on September 8<sup>th</sup> under the title “The Solution of One Aspect of Upper Paleolithic Notation.” Marshack Papers, Abelson to Marshack, 8 September, 1964. Hawkins was the first reviewer for Science and he recommended to Abelson that either Movius or Otto Neugebauer, an authority on early calendrics at Brown University with whom Marshack had been in correspondence, as the second reviewer. Marshack Papers, Hawkins to Marshack, 24 July, 1964; Marshack to Neugebauer, 27 July, 1964.

astronomical skill and tradition existed” inasmuch as the sophistication of Stonehenge “indicates an evolution of some thousands of years.” Marshack then reported what must have struck his readers as an astonishingly bold remark: “Computations and analyses I have made have disclosed evidence of lunar observation in notational sequences and markings dating from the Upper Paleolithic period” extending to around 35KYA. These very early notations, which can be found on thousands of sequences engraved on mobiliary art as well as in rock shelters and the decorated caves of Franco-Cantabria, provide the context and prelude for the later Neolithic and agricultural civilizational structures such as Stonehenge. At the time, Marshack allowed as he was surprised at how far into the past he could trace these calendric notations.<sup>18</sup>

Marshack provided four brief accounts of artifacts from three different prehistoric periods. The first two were painted Azilian notations from Canchal de Mahoma and the Abri de las Viña in Spain, around 12 KYA; the second, a piece of Magdalenian mammoth ivory from Gontzi, Ukraine, dated from the late Paleolithic (ca. 17-12KYA); the third, a piece of Aurignacian bone from Kulna, Czechoslovakia was at least as old as the mammoth ivory. All, Marshack argued, contained calendric notations. He concluded that “the questions raised by this evidence ... entail a revaluation of the origins of human culture, including the

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<sup>18</sup> Marshack Papers, Marshack to Movius, 1 November, 1967.

origins of art, symbol, religion, rite, and astronomy and the intellectual skills that were available for the beginnings of agriculture.” This rather grand statement was followed by the announcement that he had begun the task of “reconstruction of the culture of Homo sapiens in the Upper Paleolithic period.”

The timeline for Marshack’s initial achievement was impressive. In April, 1963 he returned to the troublesome paragraph about the beginnings of science. He looked at the account in Scientific American about the Ishango bone and within a short period “cracked the code” concerning what the incisions of the bone expressed, namely a calendric lunar sequence. (More cautiously one would speak of the hypothesis of a calendric lunar sequence, as Marshack later would do; at the time he was understandably more enthusiastic than cautious.) Starting in the summer of 1963, he worked for over a year in libraries looking at photographs and drawings of other artifacts in the scientific literature and tested his code-breaking technique on what he could observe from this secondary evidence. By late spring or early summer of 1964 he had a manuscript for a book based on this extensive secondary research. During the summer of 1964 he spoke with Hawkins and then with Movius, both of whom advised him on the next steps he needed to take. In November, 1964 he had taken the first: the short piece in Science established his “priority” as Movius had advised.

With Movius' help, he applied to The Wenner-Gren Foundation to study first-hand in European museums and private collections the artifacts that had become familiar to him from published accounts.<sup>19</sup> Marshack began his Wenner-Gren-supported work in the winter of 1964-5. Movius continued his support by writing letters of introduction to several senior scholars in France.<sup>20</sup> In Part I of The Roots of Civilization Marshack provided a retrospective account of what must have been an exciting and demanding couple of years and clarified two interrelated concepts that have already been encountered: notation and time-factoring.

The concept of time-factoring was initially developed in Marshack's manuscript about the space program. There he argued that "the brain was essentially a 'time-factored' and a 'time-factoring' organ." It was time factored insofar as it had evolved over millions of years as well as growing and developing sequentially in each individual human; it was time-factoring insofar as "it remembers, it reacts, it plans, it participated in the dynamics of relations and processes outside of it."<sup>21</sup> For Marshack, that is, the time-factoring cognitive

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<sup>19</sup> Movius later told Lita Osmundsen of The Wenner-Gren Foundation that Marshack's work was "highly meritorious," which was the highest ranking possible within the categories The Wenner-Gren used to evaluate applications. Movius Papers, Movius to Osmundsen, 16 December, 1969. Osmundsen agreed with Movius that Marshack should be supported even though at the time he lacked any academic institutional affiliation so that awarding him a grant would contravene Foundation rules. Marshack Papers, Marshack to Hawkins, 19 October, 1964. Movius turned Marshack into a research associate and was able to support him indirectly by way of the Peabody Museum, which was the official recipient of funds from various granting agencies. Marshack was made a Fellow of Harvard and of the Peabody in the spring of 1970, though without funds or a salary. "Ah, well, one doesn't win them all," he remarked to Gerald Hawkins (Marshack Papers, Marshack to Hawkins, 3 April, 1970).

<sup>20</sup> The included Annette Laming-Emperaire and André Leroi-Gourhan (6 January, 1965); René Joffroy (20 January, 1965) and several others. See Movius Papers, Movius to Marshack, 24 February, 1965.

<sup>21</sup> Marshack, Roots, 25.

capability of the brain was a fundamental attribute of human being.<sup>22</sup> The implications rather than the adequacy of this rather crude anthropology are of interest in the present context.

As noted above, the ability to develop and hand over a tradition was central to Marshack's concept. In the example of the Ishango bone, if it was in fact a calendric document, the author of it would have had to rely on observational skills that had taken thousands of years to develop. This is why, in the Science article, Marshack looked at material that was thousands of years older than the Ishango bone was thought to be.

Marshack drew an additional implication: if the Ishango bone was time-factored, it was because it displayed a notation. The two concepts, in other words, were tied together. "If ... we assume it [the Gontzi bone, in this example] to be notational, then it must be 'time-factored,' both in the making and the meaning." The marks on the bone must have been conceived sequentially and the author of the document, the human being who actually made the scratches, "must have known the 'story' or meaning that was being structured by the sequence," in this example, ex hypothesi, a lunar sequence.<sup>23</sup>

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<sup>22</sup> One might also argue that animals have time-factoring capabilities. This is why, for example, dogs welcome home familiars who have been absent and occasionally develop characteristic behaviors to "say goodbye" when a familiar leaves. See Frans de Waal, Are we Smart Enough to know how Smart Animals Are? (New York, Norton, 2106), 2, 33.

<sup>23</sup> Marshack, Roots, 39.

Marshack's use of the term notation attempted to preserve what he took to be the relatively imprecise or at least non-mathematical information recorded on the Upper Paleolithic art. The most obvious meaning of notation was simply record.<sup>24</sup> Some of the differences in clarifying what he meant came out in his correspondence. For example, he several times had to remind his colleagues and critics that lunar notations were not "astronomy" but at best a "precursor" to astronomy.<sup>25</sup> Because notations were sequential and so of varying periods of time, not always a single 24-hour day, they were not arithmetical either.<sup>26</sup> These sequences, Marshack said could be termed "phrasing," which suggests an image taken from music.<sup>27</sup>

His problem was, in fact, complex as well as imprecise. As he explained to Leon Svirsky, "the game I am playing is a double one. I am trying to find a pattern but I am also trying to re-create the way in which ice-age man played his game, to find his system and his pattern. This goes beyond numbers and counting.... It is not only a number game, it is also a story game and it extends to rite and ritual."<sup>28</sup> As a "story game," the notations would also convey a meaning.

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<sup>24</sup> He used the term this way in Roots, 105.

<sup>25</sup> Marshack Papers, Marshack to Glynn Daniel, 22 January, 1972.

<sup>26</sup> Marshack Papers, Marshack to Colin Renfrew, 22 May, 1971; Marshack to Jimmy McNeil, 4 May, 1975.

<sup>27</sup> Marshack, Roots, 28, 31, 53.

<sup>28</sup> Marshack Papers, Marshack to Svirsky, 1 April, 1964.

In a letter to Hawkins in June, 1964 Marshack responded to some questions Hawkins had raised about whether the notations Marshack found were representative of all the artifacts he had looked at. Marshack replied: “the order of the presentation [of scratches, lines, etc.] is not random.” It starts with simpler bones, without any hint of “art” and then proceeds to more complex examples. He noted as well that “I have done over a thousand such ‘readings’ and find that the lunar pattern and phrasing is always present.” At the same time, he said, some sub-groupings may have no astronomical significance.

They would vary month to month, season to season, tribe to tribe, culture to culture, and generation to generation. For these are “storied” periods. Usually such periods would fall under the aegis of some deity, animal, or symbol. The tendency to find such “storied” breakdowns would increase as one finds the notations more closely related to the ceremonial and storied animals. There is therefore a differentiation between observed periods and storied periods. But they are not contradictory or mutually exclusive.

“Storied” periods, which is to say meaningful periods, may refer to ritual days, days of dance, purification, good or bad luck, and so on, that sometimes may become weeks or even months, as, for instance, with initiation rites. “The point about these storied and ceremonial periods,” he said, “is that they always occur in the right season, and usually at some lunar-solar point. They are related to and come within a lunar-solar observation.”

Marshack then indicated that there were three kinds of notation: (1) day-to-day notation, which is highly correlated with lunar phrasing; this is observational; (2) entirely storied, made in advance and consisting of smaller or shorter periods within the lunar, observational count; here there is no correlation with the lunar count but these periods are (somehow) related to it; (3) a combination of the first two, based on lunar phrasing and storied periods that are related to lunar-solar points that mark events. Marshack concluded this elaborate, obscure, and highly speculative account with a more modest observation: “I suppose it is true that the main thesis of the book would hold if only one notational sequence from the ice age were clearly proven to be lunar. For the revolution in our thinking about man and prehistory would begin there.”<sup>29</sup> Hawkins rather mordantly replied: “how these notations developed into Stonehenge is not clear.”<sup>30</sup>

Years later, after having published a great deal on lunar and other notations, most of which was more focused than the rather grand notions Marshack discussed in his pre-publication correspondence with Hawkins, Marshack wrote a letter to the editor of Scientific American that distinguished between arithmetic and notational calendars by raising the possibility of a thirteen-and-a-half lunar month year when the year began with the spring equinox rather than a specific “arithmetical” date

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<sup>29</sup> Marshack Papers, Marshack to Hawkins, 14 June, 1964. The date indicated that the “book” to which he referred was the manuscript that was not published.

<sup>30</sup> Marshack Papers, Hawkins to Marshack, 16 June, 1964.

such as January first. That is, he explained, “Indian lunar ‘calendars’ were not based on numbered years of twelve set months accurately following one another but were based on set sequences of ‘moons’ that were seasonally and phenomenologically named.”<sup>31</sup> Accordingly, a lunar “year” could last from nine to thirteen “months.” In modern terminology, one would say that the notation of Indian lunar calendars expressed observed cosmological sequences.

More recently still, in a letter to Chris Scarre, Marshack called notation “a form of visual problem-solving by the maker and, at a different level, by the contemporary analyst.”<sup>32</sup> In short, for thirty years Marshack used the term notation along with associated terms such as storied and time-factored in ways that were not always self-evident. Moreover, he did so usually in an experiential context that asserted that he had looked at a lot of artifacts and this is what made sense to him and, if you had looked at as many examples and in the same way, it would make sense to you, too. It seems to me that Marshack’s terminological ambiguities, and many of his later disputes over method stemmed from the inductive procedures he adopted after he cracked the code of the Ishango bone. If, as he claimed, his only assumptions were that the bone (and other Upper Paleolithic art) was (1) time-

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<sup>31</sup> Marshack Papers, Marshack to Scientific American, 26 June, 1972. Marshack used the term “phenomenological” in the literal sense of “accounting for appearance” and not in the philosophically technical sense of Husserl and his followers.

<sup>32</sup> Marshack Papers, Marshack to Scarre, 4 May, 1995.

factored and (2) notational, so that it might possibly reflect a lunar notational story, as he said in The Roots of Civilization, he would proceed on the basis of internal evidence of the markings themselves.<sup>33</sup> And, of course, it is true that he presented his argument in The Roots of Civilization, more than in the initial article in Science in a tentative way. “Hesitantly,” and with caution, he said, he studied the photographs and drawings, but then “slowly ... the assumptions and computations, the comparisons and the eliminations of possibility began to give me feelings that at times approached certainty.”<sup>34</sup> And so, for example, when he finally got to examine the Blanchard bone or plaque at the Museum of National Antiquities, now the National Archaeological Museum, in Saint Germain-en-Laye, outside Paris, he immediately recognized, on the basis of his lengthy study of library materials, a sequential lunar pattern. As he remarked to Movius, “I actually found a Magdalenian ‘Rosetta’ stone, one bone [in the Museum] that classified the procedures and the path through some of the most difficult and complex of the Magdalenian pieces.”<sup>35</sup>

In fact, his analysis of the Blanchard plaque was nothing like a Rosetta stone, which allowed scholars to translate previously unknown Egyptian hieroglyphs into known languages because the known languages (Demotic and

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<sup>33</sup> Marshack, Roots, 38.

<sup>34</sup> Marshack, Roots, 36.

<sup>35</sup> Movius Papers, Marshack to Movius, 2 June, 1965.

classical Greek) were also inscribed on the stone. Marshack certainly knew the limits of his inductive procedures. Such insights are invariably accompanied by doubts. “Was I seeing what I had wished to see, what I had prepared myself to see?” he asked himself.<sup>36</sup> Movius raised this problem in 1967:

You should always remember one thing, namely, what you have found and seen is quite an individualistic “discovery.” In other words, another person looking at the same pieces could conceivably see something quite different from what you yourself have seen.... One has to have a great deal of very specialized background, interest and understanding in order to even begin to decipher the carious patterns which you have so skillfully depicted in your letter.<sup>37</sup>

As Grahame Clark asked him: did you select only what fit your theory? After all, “with sufficient ingenuity one can detect calendrical notation on all manner of artifacts devised for functional purposes.<sup>38</sup> That is, induction invariably introduces the issue of connoisseurship, which to critics is indistinguishable from subjectivity. Even if friendly or not-so-friendly critics had not reminded him of the problem, Marshack was fully aware of it on his own.<sup>39</sup>

Marshack’s answer was two-fold. First, he argued that his results “are neither theoretical nor interpretive, but absolute. The method itself establishes the

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<sup>36</sup> Marshack, *Roots*, 49. He made a later comparison of the Rosetta stone to a Spanish artifact, the bâton from Cuerto de la Mina, with more justification.

<sup>37</sup> Movius Papers, Movius to Marshack, 14 August, 1967. The letter referred to by Movius contains sketches of museum pieces with colors to show scratches on statues made with different points.

<sup>38</sup> Marshack Papers, Clark to Marshack, 9 December, 1968. Clark was Disney Professor of Archaeology at Cambridge and Master of Peterhouse.

<sup>39</sup> See, for example, Marshack Papers, Marshack to Michel Lorblanchet, 1 May, 1986, where he brought up the issue explicitly for Lorblanchet’s consideration.

accuracy.”<sup>40</sup> This “intensive internal analysis” was not arbitrary because it referred to external realities, namely the observable lunar sequences against which the engraved notations could be compared for accuracy.<sup>41</sup> His second answer, which concluded Part I of The Roots of Civilization, was that he had discovered, mainly through his use of a microscope on museum artifacts, “a growing series of interlocking controls.” He listed five sets of “controls:” (1) the numerical counts of groups and of sequences engraved on the bones; these sequences reinforced one another because of their regularity; (2) the “invariant phases of the moon” to which the sequences notatively referred; (3) the visualization of the moon that can be observed from earth in terms of phases; (4) the new facts brought to light by the microscope; (5) as the analysis produced accumulated results their internal consistency, comparison, and grouping would add to the plausibility of the argument. Marshack was challenged on all these points.

As noted, with Movius’ help, Marshack secured a research grant from The Wenner-Gren Foundation shortly after his Science article was accepted.<sup>42</sup> In March, 1965 he submitted a report to the Foundation providing information on how he had so far used their money.<sup>43</sup> Marshack began by characterizing the

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<sup>40</sup> Marshack Papers, Marshack to Otto Neugebauer, 27 June, 1964.

<sup>41</sup> Marshack Papers, Marshack to Margaret Conkey, 17 July, 1981.

<sup>42</sup> See Movius Papers, Marshack to Movius, 27 October, 1964.

<sup>43</sup> Marshack, “A First Report on Research on Upper Paleolithic Markings and Sequences Conducted in France,” 4 March, 1965. A copy is in the Marshack Papers, 2005.16.1.25

Science paper as presenting a new method and concept of analyzing and interpreting Upper Paleolithic engraved sequences. It was, however, limited by several “serious restrictions” and was scarcely more than the articulation of a hypothesis. “Enlightening, perhaps important, perhaps even crucial, but still only hypothesis.” Direct examination of the artifacts under a microscope overcame the limitations noted above of having to work with photographs and drawings available in the published scientific literature. Using a microscope for the first time, he examined French artifacts stored in the National Archaeological Museum.<sup>44</sup>

His most significant discovery was that, under microscopic examination, what looked like a simple design or composition to the naked eye and had been presented in the scientific literature “in uniform black-line renderings” turned out to have been made by several different tools the points of which greatly varied. He presented the Foundation with slides of several artifacts dating from the Aurignacian (45-35 KYA) to the Magdalenian (17-12 KYA) and from four different sites.

Marshack was enthusiastic about his discoveries. A bone from the Gorge d’Enfer (in Tayac in the Dordogne) that had always been considered a simple and

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<sup>44</sup> The microscope seems to have been a portable geologist’s microscope, which at one point Marshack called a “toy microscope.” It was replaced with a variable power spectroscopic microscope.

“decorated” artifact turned out to be neither. It had been engraved by more than thirty different tools on at least thirty different occasions, and was, to say the least, complex rather than simple. Moreover, the sequence turned out to be a lunar notation and not a decoration at all. Other artifacts provided even stronger confirmation of being lunar notations when examined microscopically. One artifact contained three distinct notational sequences in three different styles, each on a different face of the bone. “On this bone,” Marshack said, “it would be difficult to prove a lunar sequence unless one used a microscope to determine, not only lunar phases and sequences, but the order of marking and changes of tools.”

Marshack concluded with the observation that he was able to make his discoveries because he had the best possible technical equipment. However, the 35mm. camera he used had a close-up lens that was insufficient to show microscopic details of the grooves made by the inscribing device and had an inadequate depth of field. He proposed acquiring better equipment so as to render photographs of his discoveries in sufficient detail to be scientifically acceptable in publications. In the event, he received sufficient funds to purchase an improved binocular zoom microscope and an adequate camera that, a few years later, were routinely used by French researchers.<sup>45</sup>

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<sup>45</sup> Marshack Papers, Marshack to M. Brezillon, Ministry of Culture, Paris, 19 February, 1984.

In the spring of 1965 Marshack also obtained a grant from the Bollingen Foundation to supplement the Wenner-Gren support. In March of that year, Marshack wrote Movius a letter from Paris bringing him up to date on his work at Saint Germain-en-Laye. He noted that Leroi-Gourhan and Laming-Empeaire had visited his work room and he had introduced them to microscopic analysis. “The one problem,” Marshack said, “still seems to be a hesitancy on the part of [René] Joffroy,” the director of the museum, “to allow ‘his’ materials to be photographed and the Piette materials to be looked at.”<sup>46</sup> Initially Joffroy told Marshack that he couldn’t photograph the artifacts because the hot lights could harm the surface of the bones. Marshack replied that he did not use hot lights but a stroboscopic flash that had already been tested in New York to ensure there was no heating of the object photographed. “Not only are the lights not turned on long enough to warm the artifacts, but the bulbs themselves hardly have any time to heat. This is somewhat the same system used by biologists in photomicrography of living cells where even one degree rise in temperature must be avoided.”<sup>47</sup> Movius remarked that Joffroy “has absolutely no business whatsoever either to deny you access to the collections or to deny you permission to photograph the materials.”<sup>48</sup>

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<sup>46</sup> Movius Papers, Marshack to Movius, 2 March, 1965.

<sup>47</sup> Marshack Papers, Joffroy to Marshack, 12 February, 1965; Marshack to Joffroy, 13 February, 1965. Marshack wrote Joffroy again on February 23<sup>rd</sup> but received no reply. Presumably he continued to use the flash.

<sup>48</sup> Movius Papers, Movius to Marshack, 5 March, 1965.

In the event, Marshack was able to get access to the materials on his own. His proposed French publisher, Thérèse de Saint-Phalle, was a friend of both André Malraux, the Minister of Cultural Affairs, and of the President of the Republic, Charles de Gaulle. She arranged a meeting with Malraux's deputy, M. Cougnon, who told him that Malraux "was deeply interested in my work and asked what I wanted. He then picked up the phone and called Joffroy and told him that the Minister (Malraux) was personally interested in seeing to it that I got everything I needed and to open the Piette collection and the reserves to me." Joffroy was furious and told Marshack "it is not proper to go over my head! It is not proper to go to Malraux!" Marshack added that "I think there are hurt feelings there now and have no idea how the ripple will widen. Yet somehow I felt that the Piette collection was necessary [to examine]. Unfortunately it was obtained this way."<sup>49</sup>

Movius replied that he was "somewhat amused" by Marshack's account and added: "I certainly would not let it worry you in any way whatsoever. Joffroy himself is by no means above operating in this manner –at least according to stories I have heard. In any case, you should keep me informed of any and all developments."<sup>50</sup> Meanwhile Marshack had written a very diplomatic note to

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<sup>49</sup> Marshack Papers, Marshack to Movius, 2 May, 1965.

<sup>50</sup> Marshack Papers, Movius to Marshack, 18 May, 1865.

Joffroy explaining that the Malraux intervention was all a misunderstanding owing to his poor grasp of French and thus an impaired ability to follow the conversation between Thérèse de Saint-Phalle and Cougnon. He then asked Joffroy for permission to work during the lunch break. Joffroy replied: “I cannot allow you to work during the lunch-time, from 12 to 13.30, because that would be opposite to the regulations of the Direction des Musées de France and I am convinced that my Department would not accept this demand if I put the question.”<sup>51</sup>

Marshack’s interactions with French citizens continued. A couple of weeks later he wrote to Movius with some exciting news. He had met a school principal who wanted to know “if there was anyone in America that would want to buy his little museum and all its collection! He said he knew it was illegal, but the property is private and the government didn’t have to know.” Marshack then asked “is the Peabody interested?” Movius replied in no uncertain terms: “Do you realize that if this institution or anyone connected with it, for that matter, were ever caught in such a ‘deal,’ that would mean the end of all permits to conduct research in the field of Paleolithic archaeology in France? ... the Peabody Museum is not interested.”<sup>52</sup>

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<sup>51</sup> Marshack Papers, Joffroy to Marshack, 3 May, 1965.

<sup>52</sup> Movius Papers, Marshack to Movius, 23 May, 1965; Movius to Marshack, 1 June, 1965.

In a little over eighteen months Marshack had come a long way. With Movius' help he had shown himself to be adept at bureaucratic politics and grant acquisition as well as an innovative and technically competent scientist. He has also learned that opportunities of questionable legality were out there and were to be avoided.

### 3. First Published Reports

As is often the case with academic publication, the time between the writing of a paper and its appearance in print can stretch into years. This was certainly true with Marshack's early publications based on the direct examination of artifacts in European museums. During 1966 and 1967 Marshack wrote most of the manuscript (in English) of what eventually was published in French as Notation dans les Gravures du Paléolithique Supérieur: Nouvelles Méthodes d'Analyse.<sup>53</sup> This monograph set forth in detail for the first time Marshack's method of examining the artifacts along with a summary of his early discoveries.

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<sup>53</sup> Notations was published as Mémoire No. 8 of the Institut de Préhistoire de l'Université de Bordeaux (Bordeaux, Imprimeries Delmas, 1970) with a preface by Movius. It was translated by J.-M. le Tensorer and edited by F. Bordes and D. de Sonneville-Bordes. Bordes and his wife were friends of Movius. As is often true with the publication of a major scientific monograph, Marshack was impatient for his book to appear. The date of publication was 1970 though the Dépôt Légal was the first trimester, 1971. Additional bibliographic information can be found in Marshack's "Reply" to critics of his "Cognitive Aspects of Upper Paleolithic Engraving," Current Anthropology, 13:3/4 (1972), 474. We discuss this paper below.

Movius' "Preface" summarized Marshack's research on calendars from Egypt and Mesopotamia and how he was led to examine artifacts of a much earlier period. He drew attention to Marshack's skill as a photographer and to the significance of this new technology. Because anyone could replicate Marshack's method, "this new methodology and the results to which it leads are in no sense subjective." Furthermore, "the analyses of Mr. Marshack have demonstrated that the notations also presuppose a non-arithmetical system that differentiates the 'strokes' or the periods of notation based on visual attributes."<sup>54</sup> He concluded that Marshack had provided additional evidence for the intellectual, cognitive and symbolic capacities of Upper Paleolithic humans that go far beyond what archaeologists and other specialist had argued.

Marshack's self-appraisal was deceptively modest. Notation was, to begin with, the first detailed presentation of the evidence and the method that the article in Science announced. Most obviously, microscopy revealed information that is invisible in photographs, to the naked eye, or with the aid of an ordinary magnifying glass. The Science article used only four examples that were separated by time and space and were based on published photographs. Notation was based on the detailed and direct examination of several more artifacts, mostly housed at the National Archaeology Museum. Many of the artifacts discussed in Notation

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<sup>54</sup> Movius, "Préface," to Notation, vii-viii.

were also discussed in The Roots of Civilization, often in the same words. The first part discussed Aurignacian and Perigourdan materials (ca. 38KYA to 20 KYA) and the second Magdalenian (17KYA to 12 KYA). “If the notation hypothesis is correct,” he wrote, “it is already extremely old and both well-defined and widespread.”

He concluded from his study of the older materials that, when Homo sapiens appeared in Europe, this human being was capable of visualizing and conceptualizing complex temporal reality that included seasons and lunar changes, migration, puberty, menstruation, birth and death. “Apparently, at the center of this conceptualization of temporal reality one finds lunar periodicity and notations. This notation was possible before the appearance of writing and perhaps before any numerical system, and, in a certain sense, may have led to them.” Moreover, the notational system was taught and learned, which made it the remote source of art, religion, writing, astronomy, and other specializations that evolved from the temporal factor of any civilization. Even if we have no access to the myths, language and culture of prehistoric humans, he concluded, his analysis had uncovered a genuine technology “precisely because it is capable of reconstituting a sequential and temporal process. That is, of course, the foundation of all

science.”<sup>55</sup> He had, in other words, completed the project that he had only sensed as a puzzle during the International Geophysical Year, twelve years earlier.

The second part of the monograph, like the first, dealt with several Magdalenian artifacts that he analyzed, generally more briefly, in The Roots of Civilization. Marshack concluded from his examination of six objects found in case one at the museum in Saint Germain-en-Laye that there existed a 25 thousand year tradition of notation extending from the Aurignacian to the terminal Magdalenian. “The demonstration of this tradition and of the lunar hypothesis can appear more evident in one example than in another, but, if one considers this ensemble as the start of a body of analyses and interpretations, these six examples prove that there exists an Upper Paleolithic tradition that is very likely lunar.”<sup>56</sup>

Marshack’s achievement was not, he said, a “decoding” along the lines of writing or arithmetic –despite his earlier enthusiasm about his having discovered a Paleolithic Rosetta stone. “What has been explicated is a process according to which notations prior to writing can be analyzed and interpreted on the basis of internal data.” The assumption that made his interpretation persuasive, as Movius had noted, was that Sapiens were as intelligent as we are –for they did the notations and we deciphered them. The structural relationship between the

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<sup>55</sup> Marshack, Notation.

<sup>56</sup> Marshack, Notation, 115.

engraving of notations and the external and observed changes of the lunar world ensured that his interpretation was plausible and that it was not arbitrary and subjective.

Marshack ended this “introductory monograph” with a brief discussion of a few late Magdalenian examples that would serve as the basis for a work on the Upper Paleolithic cultures of eastern and western Europe. “The examples presented here only provide an outline of the complex problems that are encountered in the second phase of research.”<sup>57</sup> He referred to several pieces, some of which contained engravings of animals, often without notations of any kind, which made them extremely difficult to interpret because they were so clearly symbolic. “The complete analysis of engraved compositions that are at the same time notations, representations (figurations), and symbols is very complex and will be the subject-matter of subsequent publications.”<sup>58</sup> His concluding words outlined an additional research agenda: “the full tradition of symbol usage, of which the notations were a part, seems to imply that there was a periodicity and recurrence of many aspects of the practical and cultural life of the Upper Paleolithic hunter. These periodicities were recognized, symbolized in diverse ways, and probably ritualized.”<sup>59</sup>

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<sup>57</sup> Marshack, Notation, 115.

<sup>58</sup> Marshack, Notation, 117-18.

<sup>59</sup> Marshack, Notation, 120.

The reception accorded Marshack's first major publication was a preview of things to come –as was his response to it. For instance, Andrée Rosenfeld, then at the British Museum, reviewed Notation in Antiquity, a scholarly and general archaeological journal that had been published in the UK since 1927.<sup>60</sup> Rosenfeld cautiously summarized Marshack's "theory" as arguing that "some of the non-representational art on Upper Paleolithic mobiliary objects represents a system of notation which can be interpreted in terms of a lunar calendar." She did not directly assess the coherence or plausibility of Marshack's argument but noted instead that "despite the imposing list of museums whose collections have been studied," referring to the 67 museums listed by Marshack where he examined Upper Paleolithic and Mesolithic objects, "to date,"<sup>61</sup> it "is disappointing to find" that the argument "is based on the extensive analysis of six selected objects," all from Saint Germain-en-Laye (most of which were from the same display case) and the brief analysis of a few other objects. Her disappointment was not diminished by Marshack's written assurance that such a system of notation was widespread.

Nor was Rosenfeld persuaded by the evidence brought into view by Marshack's method of microscopic examination. For example, Marshack "prefers to see" two or three closely spaced lines as deliberate whereas they might have

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<sup>60</sup> Rosenfeld, "Review," Antiquity, 45 (1971), 317-19.

<sup>61</sup> Marshack, Notation, 5-6.

been made because “the ‘artist’ found it necessary to move his tool up and down a number of times to produce the required depth or width to his mark,” thus only accidentally leaving two or three lines. “This problem of procedure is not discussed when the additional lines are so fine that they become visible only under magnification (p. 64)—and their intentional nature may thus reasonably be questioned.”

A second problem “is how to decide on the ‘starting point’ of the sequence,” especially when the marks are complex (crosses, zigzags, lambdas, etc.). Rosenfeld was not persuaded that these complex marks were distinguished from simple lines and dots merely “as a matter of style,” as Marshack had said.

Third, Rosenfeld argued that “any series of marks” can be grouped according to their cross-section and kinetic properties but the problem is to determine whether the “sequences” form “some identifiable pattern or whether their arrangement is merely haphazard.” As we have seen, Marshack “proposes to test this with a model of the lunar month” but his reasons for doing so “are not clear, except presumably that the author is satisfied with the fit.” That said, Rosenfeld agreed that Upper Paleolithic peoples were aware of lunar and seasonal cycles, but “why they should choose the short term fluctuations of the moon to measure the seasonal change in climate fauna is less obvious.”

Fourth, Rosenfeld took issue with Marshack's "lack of method" more broadly, which we noted above as his inductive approach to data. She was critical or even dismissive of his statement that an observed month might vary "from 27 to 33 days depending on the choice of starting and finishing points." As a result, she said, "it becomes increasingly difficult to find any consistency in the manner in which the analyzed groupings may be matched to the lunar model." Accordingly, "one is forced to conclude that the few examples of Paleolithic mobiliary art described in this book furnish little evidence of any form of systematic notation."

Rosenfeld's dismissal of Marshack's "immensely flexible lunar model" because it meant "that any irregular sequence of numbers could be read as a lunar calendar" was pretty much complete. Her last few sentences provided an account of her own assumptions, which, one may say, were those of conventional archaeology at the time:

That Upper Paleolithic man should have been interested in the seasons is a very reasonable supposition. That he should have been aware of the motions of certain astronomical bodies is not beyond the possible. However, any Paleolithic interest in astronomy –let alone its use for calendric purposes– remains to be demonstrated.

In other words, and left unsaid was the conventional view that Upper Paleolithic human beings were too stupid to have mapped the cycles of the heavenly bodies. For example, when Rosenfeld wondered why Upper Paleolithic people chose the short-term lunar cycles to measure seasonal changes, she actually raised an

interesting issue: perhaps the notations studied by Marshack might also have recorded seasonal celestial cycles. But to conventional archaeology ca. 1970, the notion that Upper Paleolithic humans might, like their Neolithic successors be interested, say, in seasonal cycles of celestial constellations, was simply not entertained.<sup>62</sup>

Marshack replied to Rosenfeld's review in the next issue of Antiquity.<sup>63</sup> He began by reiterating his thesis, that notation can be documented by microscopic analysis and Upper Paleolithic engraved mobiliary materials and that, once documented, it can be tested for possible lunar periodicities. One assumes, he said, that a reviewer would have knowledge of six categories of evidence before presuming to discuss the material contained in Notation. The knowledge involved was of:

1. The engraved mobiliary materials. Here, Marshack wrote, "there is no indication of analytic familiarity with this class of artifact." Moreover, when she recently wrote about Magdalenian stone tools,<sup>64</sup> she was "grossly in

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<sup>62</sup> Nor, of course, was Hawkins' understanding of Stonehenge as a device for predicting eclipses readily accepted by mainstream archaeologists.

<sup>63</sup> "Paleolithic Notation: Marshack and Rosenfeld," Antiquity, 46 (1972) 63-5.

<sup>64</sup> Rosenfeld, "The Examination of Some Use Marks on some Magdalenian End Scrapers," in G. de G. Sieveking, ed., Prehistoric and Roman Studies Commemorating the Opening of Prehistoric and Romano-British Antiquities, (London, British Museum, 1972), 182.

error” regarding the presence of ochre on bone artifacts such as the Lartet plaque, which Marshack had discussed.

2. Notational and mnemonic systems among preliterate people. Here Rosenfeld simply was silent, which to Marshack indicated she knew nothing about, for example, calendars from the Nicobar Islands, which “are engraved exactly like the Upper Paleolithic notations,” thus lending ethnographic support from primitive contemporary people to Marshack’s argument.
3. Lunar observations among preliterate peoples. Rosenfeld’s lack of familiarity with the ethnological data that document the use of the moon “to measure seasonal changes” is the reason why she was “perplexed” by Marshack’s discovery that Upper Paleolithic people did the same.
4. The nature of the lunar period. Her consideration that “any irregular sequence of numbers” could be read as a lunar calendar is simply refuted by the evidence: “the lunar phases and sequences are invariant” and, despite the absence of an occasional observation, constitute a basic, self-regulatory periodicity” as a matter of simple observation. Added to her basic unfamiliarity with the evidence as shown in the first three points, Rosenfeld is also untrained: “Clearly Rosenfeld is unprepared to deal with the arithmetical, mathematical, statistical, astronomical, and probabilistic factors involved in the analysis and theory of such notation.”

5. The nature of the evidence. Even where the evidence in the form of marks is clear, large, separate, regularly spaced,” and so on, as with the Blanchard plaque, Marshack asked: “can she recognize notation?” He added that, having presented the evidence to specialists in anthropology, ethnology, semantics etc., “almost without exception it was agreed that the sequence was notational.” So the only serious question was: how do you interpret the notation? The question of whether the marks constitute a notation has effectively been answered.
6. Sequential microscopy as applied to engraved bone. According to Marshack, Rosenfeld confused his use of microscopy with analysis. The analysis used the microscopic data but only as the basis for argument regarding sequences of scratches and lines, different degrees of polish and so on. “This is no large analytic problem. It is the miniaturization of markings that particularly disturbs Rosenfeld who italicized” ‘they become visible only under magnification.’” Marshack said, in effect: so what? Miniaturization, like notational marks, is a fact. “it is one of the unexpected findings of the method,” and, very simply, “must henceforth be considered in discussions of Upper Paleolithic engraving.”

Let us summarize this dispute: in Round one, Rosenfeld said that Marshack’s “theory” was arbitrary. It relied on too few sources of data despite his

claim to have examined many more artifacts. Microscopy adds nothing worthwhile to naked-eye analysis except that it allows the analyst to “prefer” one set of scratches to another and choose the ones that support his “theory,” thus adding to the arbitrariness of Marshack’s approach. Maybe the sequences represent a lunar month, but maybe not. In short, whatever Marshack was doing, it wasn’t science.

Round Two was shorter: Marshack concluded (four times) that Rosenfeld was an ignoramus. Once he said she was simply untrained and wouldn’t know a lunar sequence if it stood in front of her. Once he indicated she was simply too unimaginative to understand what he was doing.

To this unedifying example of the non-meeting of minds (as well as of distinct British and American styles of disagreement) the editors of Antiquity gave Rosenfeld an opportunity to respond to Marshack’s remarks. “It was with some surprise that I read Marshack’s comments on my review” of Notation, she began with apparent ingenuousness. To begin with, Marshack’s discussion of the significance of ochre was not mentioned in the book. This is true, but Marshack mentioned ochre in his response only to suggest that Rosenfeld did not have a strong grasp of the evidence when, in a publication (where Marshack also appeared), she said there was no “direct evidence for the colouring of bone objects with ochre” when there was such evidence and it had been uncovered by Marshack’s microscopy.

Nor was there any discussion in Notation of ethnographic data. “Indeed,” she said, “it is one of the great weaknesses of the book” that such matters were omitted. Besides, not every pre-literate contemporary society uses a lunar calendar and, even if some do, this was not sufficient reason to think that lunar calendars were also Paleolithic. Marshack thus failed “to consider any other possible interpretations of the archaeological record.” Of course, Rosenfeld did not suggest any alternative interpretations either.

She did allow, in a backhanded fashion, that Marshack “raises one relevant question,” the problem of “markings which are invisible to the naked eye.” Such an invisible scratch is not a “record” of any kind. However, “as Marshack now states,” if these marks are merely finer or smaller than scratches visible to the naked eye, then their differentiation from visible markings would still need to be explained. Marshack tried to do so in his analysis of the Polynesian engravings, “but there also, all likely alternative explanations are ignored instead of discussed.” Again to state the obvious, Rosenfeld failed to suggest what any “likely alternative explanations” might be. On this exchange Movius wrote to Marshack: “I wouldn’t worry at all about the Rosenfeld review. That was by no means cataclysmic. She just simply did not do her homework and should be soundly spanked and sent

home from school. In other words, it seems to me that the aftermath of her silly review will catch up with her in the end.”<sup>65</sup>

In September 1968 Marshack delivered a paper at the first Valcamonica Symposium, an annual meeting of scholars that continues to the present. The petroglyphs of the Camonica Valley in Italy had long been studied by archaeologists; in 1966 Emmanuel Anati founded the Centro Camuno di Studi Preistorici to study the Valcamonica petroglyphs and organized the first symposium two years later. This was Marshack’s first opportunity to discuss the arguments that eventually appeared in Notation before an audience of experts.

He discussed a microscopic examination he had made of an amber figurine of a bear from Denmark. The photographic enlargements revealed that it had been worn and polished but to different degrees. Some parts of the bear were unpolished, others so worn that the original hatched pattern was scarcely visible. “It was clear that, whatever the precise meaning of the bear, it had been sculpted for some ‘storied’ purpose. Afterward it had been kept and handled for a relatively long time.”<sup>66</sup> Microscopic examination of all the engraved marks on the bear enabled him to determine the sequence and the configuration of the cutting points making the marks, including the sequence when the scratches crossed each other.

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<sup>65</sup> Movius Papers, Movius to Marshack, 3 February, 1972.

<sup>66</sup> Marshack, “New Techniques in the Analysis and Interpretation of Mesolithic Notation and Symbolic Art,” in Anati et al., Symposium International de l’Art Préhistorique (Capo di Ponte, Editioni del Centro, 1970), 480.

“This made it possible to test the groups sequentially for any periodicity” and to determine the range of styles used. The point of determining the sequence of the engraving and whether one particular scratch had been over-engraved at a later date indicated that the artifact was used over a long period of time and thus, in Marshack’s language, was “storied” in the sense that whatever its purpose (such as having use in a ritual of some sort or marking a lunar sequence) that purpose could be described in a narrative. Moreover, statistical analysis of the microscopically obtained data indicated what the story was: “a sequential composition which, with a high degree of probability, seemed to indicate lunar phrasing.” Marshack performed a similar analysis on a stone slate and an amber pendant and concluded “the probable sequential order of their marking reveals a close lunar phrasing.”<sup>67</sup> “Our intent,” Marshack concluded, “has been to show that a tradition of notation in the Mesolithic, can be documented by a new methodology and technology and that there was a ‘time-factored’ use of the mobiliary artifacts, whether the artifacts were art as in the amber bear or non-representational as on the pendant or stone slate.”<sup>68</sup> Whatever the precise meaning of the pattern of notations, about which Marshack did not speculate, he did show that his approach provided a new interpretation of these very old materials and that there existed “the possibility of relating some of

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<sup>67</sup> Marshack, “New Techniques,” 488, 490.

<sup>68</sup> Marshack, “New Techniques,” 490-91.

the insights gained from the mobiliary materials to the contemporary parietal renderings.”<sup>69</sup>

Two days later, Marshack wrote Movius about his first experience delivering a paper before specialists. “I was put in the last session, Saturday morning, devoted to topics of general interest, among ‘amateurs’ and philosophers of art and religion such as Marie König.” She and Herbert Kühn had delivered “philosophical, romantic interpretations” characteristic “of the old school.” In contrast, the response to Marshack’s paper was quite unexpected. “The reaction was electric. I think the symposium including Anati, was stunned.”<sup>70</sup> Movius replied by congratulating Marshack and later cautioned him about Kühn; he said nothing about König.<sup>71</sup>

Marshack published two articles in 1969. It is not clear when he wrote them. The first was a report on his microscopic examination of Italian artifacts.<sup>72</sup> He noted that not only did he use a stereoscopic zoom microscope with a magnification range from 10x to 60x, but that the report was the result of five

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<sup>69</sup> Marshack, “New Techniques,” 494.

<sup>70</sup> Marshack Papers, Marshack to Movius, 30 September, 1968. In May 1968 Marshack sent Joseph V. Stewart, an archaeologist at Berkeley, two of König’s papers on the cosmological significance of Upper Paleolithic art (“Zur geistige Situation des Jungpaleolithikers,” *Psychologische Beiträge*, 3 (1957), 476-7, and “Die Symbolik des Urgeschlichen Menschen,” *Symbolion*, 5 (1966), 121-8. He explained to Stewart that his notational technique was not the same as König’s, but that nevertheless notations could be “built” from “unit symbols” into sequential groups that were usually lunar but could also be used “in a non-lunar context on the cave walls.” That is, Marshack’s notational studies were not incompatible with König’s, notwithstanding her “romanticism.”

<sup>71</sup> Movius Papers, Movius to Marshack, 7 October, 1968; 18 November, 1968.

<sup>72</sup> Marshack, “Polesini: A Reexamination of the Engraved Upper Paleolithic Mobiliary Materials of Italy by a new Methodology,” *Revista di Scienze preistoriche*, 24 (1969), 219-81. Page references are in parentheses in the text.

years' work, which meant it also presented the results of his library work on the published secondary materials. For the first time he drew out some of the implications of his new technique.

Most of the Italian artifacts had been analyzed previously in light of the categories developed by Abbé Henri Breuil on the basis of his work on the style of the Franco-Cantabrian and eastern Spanish traditions. Marshack proposed looking at the Italian mobiliary art on its own and without reference to Breuil's concern with hunting tallies and magic (220-1). By hunting magic, Marshack meant the use of an animal image that would be engraved to represent "a ritual of ceremonial killing to assure success in the hunt with the implication that the hunt is for food" (236; see also 226). Such discussions, he said, "entailed neither a precise methodological analysis of the materials nor an adequate definition of the concepts that were conjectured" (221). They were simply analogies developed on the basis of observation of modern primitive societies.

The Polesini materials included several examples of the "killing" of animals and of "weaponry." The question Marshack asked was whether microscopic analysis confirmed the interpretation given similar images in the decorated caves farther west. The first thing he discovered with the Italian mobiliary art was that a horse image had been reused or renewed. "Apparently it was the concept of 'HORSE,' rather than the particular drawings of a particular horse, that was

involved in what seemed to be ‘killings.’” A similar practice occurred in the cave art but there it was “difficult to determine if these additions were made within a limited period or even by the same culture.” With the Polesini materials the time scale of engraving on a single bone was necessarily limited because. For instance, an old and dried-out bone cannot easily be engraved. Moreover, for the same reason, the culture involved (and perhaps even the individual doing the engraving) must be the same. That is, two variables in the cave art were controlled in the Polesini artifact.

His first conclusion, therefore, was that, for example, the reuse of a horse image way overengraving indicated that it had a ritual use and was not just a single image used to ensure a successful hunt. Thus the image “was never fully ‘killed’ [as the hunting-magic theory required] and must represent, symbolically and mythologically, something more than food. It is a sign and symbol with a meaning, duration and constancy that indicated it was to some extent mythologized” (226). A corollary was that the “renewal” achieved by overengraving was an index of an act of participation in the generalized symbol “HORSE.”

From this analysis Marshack drew two conclusions regarding the cognitive capacities of those who made and used the Polesini art: (1) a bone, a stone, or a cave wall “can serve as a slate or a surface for the accumulation of renewal of symbolic images” and (2) “these images maintain a continuity of meaning in time”

in the sense that the meaning does not end with the alleged magical “killing.” Thus the mobiliary art was not a “sketchbook” for the more meaningful parietal art so much as “one aspect of a comprehensive system of symbol usage that also applied to the wall art” (230).

Cognitively, the accumulation of images “approaches ‘notation’ since the slate is kept and the additions tell a ‘story’ or make a ‘sum.’” And these additive symbols can lead to development towards new meaningful form of symbol not limited to hunting magic. That is, the notations are open-ended in their ability to tell a “story.” Moreover, the style of cumulative marking on a slate occurred from Aurignacian times to the end of the Upper Paleolithic in the Magdalenian and is not confined to representations of animals and images (231, 234). Marshack rejected the hunting magic theory, therefore, because the theory was too simple to account for such a complex composition.

Specifically, the hunting magic theory was wrong because “both the animal and the dart had become symbols and ... the relation between them had been assumed the aspect of a language of signs in which the animal and the dart were ‘storied’ and the ‘killing’ was mythological.” Marshack pushed this analysis even further by arguing that “the dart as symbol or sign had assumed significance apart from any species of animal supposedly intended to be killed” (244). The implication was that the “killings” might also represent a sacrifice, a healing rite,

seasonal rite, initiation rite, or a pregnancy rite because they are repetitive and thus time-factored, and because the constancy of the imagery indicated that what was renewed was not a constant desire for meat but the story of the animal (250).

Moreover, the argument also applied to the darts used to “kill” the animal. With the more abstract renderings of animals, the focus was on the dart, which suggested a second general interpretation: the arts or the “dart story” or “dart symbolism” could be used “in conjunction with animals and also, meaningfully, alone (260).” Specifically, while the symbolism of the dart or weapon by itself has been noted as a possibility in the cave art, “the difficulty of establishing simultaneity or a chronology has made the interpretation uncertain.” With the Polesini materials under the microscope, simultaneity can be established, thus raising the question as to the meaning of “the group or ‘set’ of darts as a unit with a possible group symbolic meaning.” That is, the “set” of darts may represent a “scene” such that the animal implicitly involved, if there were one, need not be represented. Perhaps there was a “ceremony of the dart” rather than of the hunt (267).

Marshack was later accused of being overconfident in his interpretation, so an example of what, in fact, he was doing might be useful. Here is one description of a microphotograph, which was reproduced in the article:

There is one flat fragment of bone that has two “sets” of feathered darts, each set made by a different point and at a different angle. Each dart in the set of five darts at the right has the engraved serpentine markings on the feathers clear to the eye. However, the set of six fragmented darts at the left has these serpentine markings visible only when we examine them by microscope. Despite the fact that each set is composed of the same sort of darts, we have a clear group concept. The differences in the points doing the engraving validate this “set” concept. In addition, the microscope shows that some of the darts in the set at the right do not touch the top edge, and others do not touch the bottom edge, so this group seems to have been self-contained within this general area. The group to the left also does not cross over the bottom edge; however, these darts do cross over the earlier, long single line which is engraved at an angle, and this long line may therefore represent a generalized animal back. These two sets of feathered darts were then crossed over by extremely schematized darts made at a right angle. The line rendition reveals the obvious primacy of the dart image over the animal image and again indicated a concept of the set as opposed to or used with a single dart (268).

If this interpretation is plausible, the weapon might also be symbolized as being meaningful in contexts other than hunting, “such as healing, trance, dance, sacrifice, initiation, and propitiation.” That is, the darts as well as the animals may have been “storied” and to some extent may have been separately storied.

A further implication Marshack drew was that, even though “both the dart and the animal as symbols had a mythological and cultural constancy,” the precise images might vary in terms of style or degree of realism or abstraction. Indeed, the variability of images “suggests that, despite ‘style,’ the concept was a cognitive aspect of a well-known symbolic tradition” (270). In contemporary interpretive language, Marshack argued that the same image of artifact could express a wide

range of meanings that may only be distinguished at a later period. As Northrop Frye said, such images are polysemous.<sup>73</sup>

Marshack drew two conclusions. The first appeared to be rather modest. His purpose, he said, was neither to confirm nor deny the hunting magic theory so much as to indicate that alternative interpretations were possible. And yet, his microscopic analysis indicated that the same sequence of engraved images could serve several distinct cultural purposes. It is conceivable that one such cultural purpose may indeed have been hunting magic, though Marshack provided plenty of evidence that this was unlikely. Besides, the hunting magic theory claimed to be exclusive, so that any polysemous interpretation such as Marshack advanced was necessarily a denial of the validity of the hunting magic theory. In short, the implications of Marshack's innovation had an unavoidable critical or even polemical dimension so far as conventional and received accounts were concerned. As Movius had earlier told him, archaeologists do not easily welcome or even accept novel approaches and interpretations, particularly when made by "outsiders." Nevertheless, that is often how science improves.

The second conclusion seemed more ambitious but in fact was a reiteration of a remark he made on the basis of the IGY research: he rejected the notion of

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<sup>73</sup> Frye, The Great Code, (Toronto, Academic Press, 1983).

“suddenness” in history, including paleohistory. In light of later agricultural religion, symbolism, and writing, “the significant fact” that his study had uncovered “is that Upper Paleolithic man had begun to use and keep a single slate to accommodate and accumulate a series and sequence of related symbolic images, whose meaning has a constancy and whose use was periodic.” Thus the cognitive tradition, not the precise meaning of any specific factor, was what he considered to be his most important discovery. Its importance, moreover, consisted in its having a “potential for development and for increasing specialization” (272). As we shall see, this insight turned into a constant theme in his work.

A second article written in 1969 provided further published microscopic analysis of additional artifacts, this time showing that the Lartet “knife” was not a knife since it showed no evidence of use in cutting. The microscope also revealed that a slate in Saint Germain-en-Laye had been ochred after it had been engraved, which “perhaps indicates that the bone had a symbolic of narrative content beyond that which would normally apply to a daily utilitarian object.”<sup>74</sup>

A year later Marshack published a paper describing his microscopic analysis of the “bâton de commandement” of Montgaudier.<sup>75</sup> The bâton, an engraved

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<sup>74</sup> Marshack, “Upper Paleolithic Objects in the British Museum: A Comparative Analysis of Two Fragments by New Methods,” in Sieveking, ed., *Prehistoric and Roman Studies*, 140.

<sup>75</sup> Marshack, “The Baton of Montgaudier,” *Natural History*, 79 (1970), 56-73. A French version, “Le Bâton de Commandement de Montgaudier (Charente): Réexamen au Microscope et Interprétation Nouvelle,” *L’Anthropologie*, 74, 5-6 (1970), 321-52, is a more comprehensive analysis that also included discussion of two

reindeer antler, had hardly ever been seen, having been tucked away in a dimly lit cabinet at Saint Germain-en-Laye and was best known by the publication of Breuil's line drawings of fish and seals on it. For interpreters there was already an interesting problem: the seals were realistic, but Montgaudier was a hundred miles from the Atlantic. Where did the artist see the seals? Did they come up the nearby river or did he (or she) visit the coast, which during the late Magdalenian was even farther away?

To consider these and other questions in 1967 Marshack first removed the protective wax from the bâton and put it under the microscope. This enabled him first to correct several of Breuil's misinterpretations. What Breuil thought was a mackerel with its mouth closed was a male salmon with a kipe, an extension of the lower jaw that develops during fall spawning season. What looked to the naked eye (and to Breuil even with a low-power magnifying glass) to be a nondescript blob was revealed to be a "spring sprout" by the microscope. Another was the head of an ibex with an "X" on its brow "as though it had been symbolically marked or crossed out after it had been made." A second "extremely schematized" ibex head was scratched near the first. Three forms, which were called "barbed weapons," by

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other artifacts, the La Vache (Ariège) "dagger" and another from Cueto de la Mina (Spain). They are also all discussed in Roots of Civilization.

Breuil were also near the ibex and salmon and they turned out to be “carefully drawn plants” not darts or harpoons.

On the reverse face of the bâton were two intertwined serpentine images and some small forms, one of which had previously been called an “insect,” and that Breuil had drawn as a medallion. Under the microscope it turned out to be a flower in full bloom. So Marshack found three plant images, each of which was seasonal—from spring sprouts to mature flowers. This raised for him the question: “why had the hunter been interested?” What was the story that the development of a plant had for a hunter?

Turning then to the major engraved image, that of the seals, Marshack discovered that they were not two species, as had been thought, but a male and a female or a young animal. This image was also seasonal, whether the smaller animal was a female or a seal pup, because bulls collect harems and the young are born and learn to swim in the fall. Likewise, the serpentine images, which Breuil considered to be eels, are also seasonal: they were of grass snakes that appear in the spring. “What we have, then,” wrote Marshack, “is a composition in which diverse species from separate realms (ocean, river, ground and mountain) are differentiated according to their season of appearance, sex, and stage of maturation.” Marshack initially speculated in the English version that all the engravings were related to spring and summer but the French version corrected

that interpretation since the ibex were not seasonal and the salmon spawned and the seals whelped and mated in the fall.<sup>76</sup>

Despite these errors in detail, Marshack's microscopic analysis was again insightful in correcting previous interpretations. He added two additional remarks that proved to be significant for his later work. The first was that analysis of mobiliary art may provide clues for the significance of the cave art (he raised this as a question in the English version and as a conclusion in the French). Second, Marshack again noted that, however important the development of technocomplexes and tools may have been –so important that we still refer to various periods in terms of the tools used by humans living during the periods when they were used, and even though many archaeologists consider “the art of these early men [to be] subsidiary,” nevertheless, the Upper Paleolithic “was also the first age in which there appeared a complex human art and symbol.” The new information revealed by microscopic analysis suggests “that the development of this intellectual symbolizing skill was, perhaps, more important in the eventual development of civilization than were tools.”<sup>77</sup>

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<sup>76</sup> The version in The Roots of Civilization, p. 173, returned to the possibility that the storied images of the animals “represented the birth of the ‘new year’ if not calendrically and arithmetically at least observationally and probably in story.”

<sup>77</sup> Marshack, “The Baton of Montgaudier,” 59.

“Cognitive Aspects of Upper Paleolithic Engraving” was submitted to Current Anthropology at the end of December, 1970. The journal was founded in 1959 by Sol Tax, a distinguished anthropologist at the University of Chicago. For a non-specialist, Current Anthropology is interesting for two reasons. First, it publishes research across all anthropology sub-disciplines, from primatology to analysis of the forensic anthropology TV show, Bones. Second, and nearly unique in the area of scholarly publication, it not only publishes new research and methods but also responses of specialist peers to the original article, which is then followed by the author’s reply to the critical analysis. It often makes for exciting reading. Marshack’s sixteen-page paper was followed by nine pages of critical discussion and a five-page response to it.<sup>78</sup>

Unlike the decorations on cave walls and rock shelters, which are geographically concentrated and temporally focused, he began, mobiliary art is found all over Europe and dates from the Aurignacian to the late Magdalenian (34KYA to 12 KYA). He then provided what is by now a familiar report of microscopic analysis of the Blanchard plaque, the Lartet “knife,” and artifact A212 from Les Eyzies, all of which were Aurignacian, and all of which, he argued, showed evidence of a non-decorative and non-utilitarian cumulative notation “with a complex system of visual-kinesthetic and spatial differentiations for the sets, sub-

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<sup>78</sup> Current Anthropology, 13:3/4 (1972), 445-77.

sets and larger superordinate groups.” As the Upper Paleolithic proceeded, regional styles evolved from this initial “tradition.” Here Marshack introduced evidence from Ukraine to Moravia, Italy, the Pyrenees, and Spain, including the bâton of Cuerto de la Mina, which he discussed in the French version of the article on the Montgaudier bâton. All the documents were time-factored, “referring not only to the sequence of engraving but to the probable cultural meanings in these symbolic accumulations.” There was something more to be discovered in the late Magdalenian bâtons engraved with plants and animals, including the ibex with an “X” on its forehead: “it would seem,” Marshack wrote, “that the images represent stories explanations and myths summing their associated marks. They thus have been related to seasonal, economic, or ritual recognitions or activities.”<sup>79</sup>

Before discussing the “cognitive implications” of his analysis of these Upper Paleolithic artifacts, Marshack provided a highly understated summary of his argument. First, his hypothesis concerning calendric notations first presented in the 1964 Science article was strengthened by the microscopic analysis. Moreover, now it included chevrons, lambdas, grids and hash marks, all of which were notations that “were exceedingly complex, cognitively and culturally.” Second, and more significant, the lunar hypothesis “suggests that the Upper Paleolithic notations represent one class of symbol and therefore a specialized cultural usage of the

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<sup>79</sup> Marshack, “Cognitive Aspects,” 447, 456.

general cognitive capacity.” In the language of compactness and differentiation of consciousness, lunar calendric notations were one expression of a differentiating human consciousness. Or, if one prefers, such notations expressed Aurignacian human consciousness. That imagery became part of a “tradition” that eventually became or found expression in the imagery of the late Magdalenian bâtons. In Marshack’s language, “the body of mobiliary materials documents the presence of other forms of symbolic marking, including nonlunar notations, and these were apparently used in their own specialized contexts.”<sup>80</sup>

By next considering the “Cognitive Implications” of the changes from lunar notation to the symbolism of the late Magdalenian bâtons, Marshack introduced questions “of a different order” than the conventional questions raised by archaeologists and paleoanthropologists regarding the evolution of language and tool-making. These new issues concern “integrative” problems “and entail the full constellation of human cognitive skills,” which we have discussed in terms of the very early differentiation of human consciousness. Marshack, who also used the language of differentiation to describe the more diverse and complex imagery and engraving of the later period that expressed “a sense of recurrence and periodicity as well as a sense of constancy within the open, variable system,” did not claim to grasp the “sematic content” of the symbolism – what the imagery in detail might

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<sup>80</sup> Marshack, “Cognitive Aspects,” 455-7.

mean or express in a way that could be recovered in a narrative. Rather, he sought to understand the notations and their development “as normal cognitive products of the fully evolved, genetically modern human brain.” He then discussed certain problems in neuropsychology as they were understood in the late 1960s, not in order to “explain human cognition” but to “isolate its components and indicate its physical, material basis.”<sup>81</sup> Not here, nor anywhere else so far as I know, did Marshack explain why he dealt with the experiential complex of consciousness and symbolization by reducing this complex to brain physiology. In any event, his anthropological argument can be understood independent of a rather juvenile metaphysical prejudice.<sup>82</sup>

Specifically, Marshack had unquestionably made a significant discovery, that the maintenance of a twenty-five thousand year tradition from the early Aurignacian to the late Magdalenian “would seem to imply a developing complexity of the structured interrelations of which the notations were a part.” Moreover, his speculation that the examples of notations analyzed in this and in previous papers “would be of less value to an isolated, barely subsisting nuclear family than to specialized groups of persons involved in storied, traditional,

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<sup>81</sup> Marshack, “Cognitive Aspects,” 457.

<sup>82</sup> Movius wrote to Marshack that the section on cognitive implications “left me completely breathless –I was unable to follow your argument. For this reason, I strongly advise you to rewrite this entire section, clarifying your ideas and expressing them in a much more direct and simplified manner. In short, it seems to me that you became absolutely drunk with words.” Marshack Papers, Movius to Marshack, 7 April, 1970. Marshack did rewrite the offending section and removed some of his more extravagant (and unsubstantiated) speculations.

recurrent interrelations and interactions,” which is to say, tribes, clans, bands, etc., is entirely reasonable. In other words, there is an interrelationship between the development from simple notation in the early Aurignacian to a more complex “symbolic repertoire” in the terminal Magdalenian. Marshack’s conclusion, that this symbolic repertoire was independent of evolving tool technology and provided meanings and stories (storied meanings or meaningful stories) about “the sky, the seasons, and the biologic processes of man and nature” also seems to me to be entirely reasonable.<sup>83</sup>

Most of the critics whose remarks followed Marshack’s paper focused on the hypothetical nature of Marshack’s argument and its evident open-endedness, which seems to me to be its greatest strength. David S. Brose, for example, noted that Marshack’s hypothesis was “interesting” but “the data needed to test the hypothesis are simply not available in this article. Nor is there any clear statement of exactly how such hypotheses could be tested.” Movius provided a splendid summary of the origin of Marshack’s project and of his argument. He endorsed Marshack’s claim that “the cognitive complexity of the engraved symbol systems of early Upper Paleolithic man was demonstrably greater than that of any of the iconographic systems of known historical hunter-gatherers ever recorded” despite the fact that neither he nor Marshack could claim expertise in the “iconographic

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<sup>83</sup> Marshack, “Cognitive Implications,” 461.

systems of known historical hunter-gatherers” nor did they refer to any other discussions of contemporary primitive societies.

In his reply, Marshack stressed two things: first, that his microscopy created new data by transforming known artifacts into a new intelligible unit of meaning suitable for further study. Particularly the late Magdalenian images of seedlings, flowers, leafing and leafless sticks, of male and female animals at different seasons, etc., “are so precisely rendered that one must assume that the images represented not genetic plants. Birds, fish, or animals, but cognitively, linguistically, and culturally differentiated species, characteristics, processes and interrelations” often in ritual or sacrificial contexts.”<sup>84</sup> The second thing Marshack stressed was that the place of lithic manufacture as an element in “symbolic manufacture” had been neglected in the study of lithic assemblages.

The leap in cognitive complexity involved in the manufacture of symbol and image can be theoretically derived from the evolution of a generalized cognitive capacity for time-and-space conceptualization and abstraction, with tool-making and language as aspects of that development. Image- and symbol-making cannot be derived from tool-making as a manipulative skill. It is the specialized use of this generalized capacity, then, that is apparent in the Upper Paleolithic notations.<sup>85</sup>

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<sup>84</sup> Marshack, “Cognitive Implications,” 470. Marshack also responded to a couple of critical analyses that arrived too late to be included with the original article. See Mary Aiken Littauer, F.D. McCarthy and Alexander Marshack, “On Upper Paleolithic Engraving,” *Current Anthropology*, 15:3 (1974) 327-32

<sup>85</sup> Marshack, “Cognitive Implications,” 472

One thing we may conclude with confidence: Marshack's use of microscopy would lead to a lot of archaeological re-thinking, and not just about lunar notations. His discussion of the Polesini horse, for example, indicated that it was used as part of an activity, which we conventionally call ritual, that took place over a long period of time. It was polished by use, even by human handling, and so was not an instance of a one-time hunting magic. Likewise the amber bear discussed at the Valcamonica Symposium was "symbolic art" as well as a vehicle for notation. That Marshack was open to criticism was obvious. His inductive approach to the materials led him to criticize his detractors because they didn't have his familiarity with a microscopic examination of the artifacts. But then, nobody did but he. And the real conflict was between his inductive collection of evidence and what is loosely called the hypothetico-deductive approach of conventional or "normal" archaeological science. In the case of Upper Paleolithic mobiliary artifacts, the absence of hypotheses regarding the meaning of the materials, their "semantic content," led time and again to archaeologists' insistence that "we don't know what it means" often because "we can't know what it means," And to ensure matter remain in a state of ignorance the implication was that we never will know what these mobiliary artifacts –let alone parietal art– means. Marshack challenged this doctrinal insistence on never being able to know what Upper Paleolithic art means. It is hardly surprising that his critics disagreed nor that Marshack responded to

them with impatience and aggressive rhetoric. Rosenfeld was merely the first to be “surprised,” which is to say, offended, by Marshack’s lack of academic gentility. If Marshack was aware of the limitations of induction, he never said so.

#### 4. From Notation to Story

We have already quoted from, and referred to, Marshack’s major English publication, The Roots of Civilization. As with the author’s complex and inductive argument, this is a multi-faceted publication. It is beautifully illustrated but the photographs are not just of the famous parietal art of the caves. Marshack also reproduced many microscopic photographs that are beautiful in the way that X-ray images are beautiful to a radiologist. The Roots of Civilization was the result of nearly a decade of work, and both sums up the insights he had accumulated and set the stage for subsequent work. In this respect it was a book much like Notation, which concluded with the observation that the discussion of the artifacts presented in the monograph “only provide an outline of the complex of problems that are encountered in the second phase of the research.”<sup>86</sup>

By 1969, before either Notation or The Roots of Civilization were near completion, Marshack said he had taken 8000 photographs “and could conceivably

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<sup>86</sup> Marshack, Notation, 115.

do a paper on each of the hundreds of pieces I've examined. One stage of the research, then, is done." He had maintained a hectic travel and research schedule and had several times fallen ill from exhaustion. As he wrote to Movius in the spring of 1969 when he thought Roots was in production, (in fact, his revisions meant that it would take another couple of years to appear): "In one sense, then, I have completed what I set out to do five years ago and am emotionally depleted."<sup>87</sup> He immediately added that his next book was to update Notation: "I feel close to an understanding of a major part of all Upper Paleolithic 'art' and 'symbolism' with the microscopic methodology working across the board." In the event, he turned to Notation and made several revisions, which in turn found their way into The Roots of Civilization. In the spring of 1970 Marshack wrote to Movius: "one way or another, I have enough research plans to keep me busy for many years and more writing than I can ever complete. I have not had a solid week of vacation in these six years."<sup>88</sup>

One of the major achievements of The Roots of Civilization, then, was to set out systematically and in detail Marshack's account of notation and its confirmation by lunar calendrics. Marshack also reflected on the importance of the story and of "storied symbolization." Even though he did not always later adhere to

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<sup>87</sup> Movius Papers, Marshack to Movius, 31 March, 1969.

<sup>88</sup> Movius Papers, Marshack to Movius, 26 May, 1970.

his own insight regarding the significance of the story, it seems to me that this was his most important discovery so far as political science is concerned.

Marshack was not led to his understanding of stories and of story-telling on the basis of a theoretical or philosophical argument. Rather, in keeping with his inductive approach to the materials, he gradually gained a new perspective on his own discoveries. In Chapter Seven, of The Roots of Civilization, “Time-Factored Thought,” Marshack began by discussing the limitation of understanding humans in terms of their tool-making abilities. “If,” he said, “we consider man during his evolution or hominization as basically a toolmaker, then it is relatively easy to trace a line of development in this toolmaking ability through the biological fossil artifacts.”<sup>89</sup> Marshack, however, argued that tools were but one aspect of “a wider, cognitive, cultural evolution.”

He considered the implications of the control of fire, which hominins have been able to do for over half a million years. “The demands of a fire culture are strict.” The lore might vary among different cultures, but all would have to learn that, for instance, wet wood burns less well than dry, green grass less well than brown, and so on. More important, Marshack argued,

fire is “alive.” It must be tended; it needs a home and a place out of the great winds, the heavy rains, the deep snows; it must be constantly fed; it sleeps in embers and can die, yet it can also be blown back to life by the breath; it can burn a hand; it sputters angrily and brightly with animal

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<sup>89</sup> Marshack, Roots, 109.

fat; it dies entirely in water; it whispers, hisses, or crackles, and therefore has a variable “voice;” it uses itself up, transforming a large weight of wood to gray ash, while climbing by smoke and savor to the sky, at last disappearing in the wind; one can carry its spirit of “life” on a burning branch or ember to make a second fire. To a man with fire, then, there is a continuous involvement in a complex, dynamic process which creates its varying, yet “artificial,” demands, relations, comparisons, recognitions, and images.

Moreover, the constant requirements of tending fire “tie one down in time and thought.”<sup>90</sup>

Equally significant, a culture of fire assumes if not language then a capacity to communicate sufficient to maintain the fire. More generally, “the specific ability to create and maintain a continuous, dynamic, changing, and increasingly complex, time-factored, artificial culture is human.” Marshack immediately attributed this entire process to the evolution of the brain. More important than this nod to biological reductionism, Marshack noted that when humans exist in such a way that is implied by a fire culture, their existence is already storied in the minimal sense that, for example, he or she can explain to another how to keep a fire going or where to find deer tomorrow. Marshack’s story of stories was straightforward: “the evolution of the broader, time-factored and time-factoring capacity, including the skill of toolmaking and language ... leads eventually to the notations and art.” This insight, Marshack said, allowed him to proceed with his research and hinted at

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<sup>90</sup> Marshack, *Roots*, 113. See also Richard Wrangham, *Catching Fire: How cooking made us Human*, (New York, Basic Books, 2009).

the reasons that made his research possible: since notations and art were part of human kinesthetic and cognitive capability, “and since this capacity was broader than that involved in a specific toolmaking skill or in the physiological skills required for the articulation of one language, I could, with a comparable cognitive capacity, try to re-create some of the specific uses.”<sup>91</sup>

That is, Marshack’s story of stories demanded that he use his imagination to make sense of the data he had observed --as notations, for example. The “generalized capacity” that enabled him to do so was the same capacity, he argued, that enabled early hominins to invent tools, words, and stories. And by story he meant “the communication of an event or process,” such as fire-tending, but also other time-factored experiences from memories of past activities and places to projections of future actions, specializations, seasonality, and so on.

As with his discussion of mobiliary art, his purpose was not to explain what a particular piece meant but to indicate that, whatever it meant, it was a storied meaning. So, for example, he argued that, when Sapiens left Africa for the rest of the Old World, their tools, food, morphology and probably group relations and stories changed. What did not were the cosmic rhythms: sun, moon, stars, seasons, along with birth and death. To explain or account for such rhythms, Marshack said, Sapiens told stories that made sense of observed changes and allowed them to

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<sup>91</sup> Marshack, Roots, 118-19.

“participate” in the stories and thus in the changes the stories evoked. Thus the lunar calendric notations were now described as “remembering marks” of a lunar story. “A painted or engraved composition, even when not realistic or figurative, often had a complex storied meaning.”<sup>92</sup> Looking at the earliest notations and comparing them to later ones, Marshack saw a time-factored, storied meaning involving, for example, seasonal rhythms that he could both understand and comprehend how later expressions of seasonal periodicity developed from the earlier.

This interpretive strategy did not mean Marshack could “read” the images and marks of any particular artifact –a bâton de commandement, for example. However, looking at the artifact “an extraordinarily complex composition has begun to seem organized, purposeful, notational, and part of a tradition that composed storied sequences or sums with a repertoire of images. The way of thinking is one we understand.”<sup>93</sup> Here he provided more details on the Cuerto de la Mina bâton discussed briefly above. In the winter of 1968, Marshack recalled, he visited the Natural Science Museum in Madrid to examine some Upper Paleolithic materials. “I realized I had stumbled on a unique example, the one composition in all Europe that validated the many hypotheses, theories,

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<sup>92</sup> Marshack, Roots, 125, 136.

<sup>93</sup> Marshack, Roots, 212.

conjectures, and findings I had pieced together so laboriously in an analysis of hundreds of other examples.” This bâton combined engravings of plants, animals, and notational counts. “The forms or images [of ibex or plants], having been separated from the notational groups, it becomes clear that they were intended to serve as symbols in relation to the sums of marks near each... We have on this bone, therefore, the first sure validation of the symbolic use of art and sign in relation to notation” There were a few “uncertainties,” Marshack allowed, but even so this bâton was (yet another) “Rosetta stone” insofar as the seasonal markings – the ibex as the symbol of spring or the plants as symbols of late summer and fall–verified the lunar notations.<sup>94</sup>

As with Marshack’s earlier remarks, “whether the reading of each symbol is correct or not, what we have here is clearly a calendric system combining signs and notations in a highly evolved Magdalenian style. The notations indicated the usual lunar sequences; the symbols indicted the association of a particular period with an animal or plant form or stage and perhaps indicated (as it does on later calendars from the Greeks to the Yakuts) the moment for a significant rite, myth, observation, seasonal change, and so on. Marshack found the same association of plants, signs and animals in the cave imagery, which indicated to him that “to some

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<sup>94</sup> Marshack, Roots, 216.

extent the same basic stories and basic images would be involved” and associated “with both the caves and the mobiliary artifacts.” That is, the cave imagery was also seasonal.<sup>95</sup> In Lascaux, for example, the “Chinese” horses are mares and either pregnant or potentially pregnant and are associated with spring plants. Likewise leafy branches are associated with cows and mares and spring calving and foaling; bare branches with stags, stallions, and bulls –and the fall rut.

Marshack also discussed horse engravings, including the famous Vogelherd horse, their “reuse,” over-engraving and handling and polishing, which suggests the horse had a symbolic rather than a nutritional value. Following an extensive and detailed analysis of both cave and mobiliary art, particularly from the late Magdalenian, Marshack concluded:

The repertoire of images found across the Upper Paleolithic of Europe, therefore, suggests a storied, mythological, time-factored, seasonal, ceremonial and ritual use of animal, fish, bird, plant and serpent images, and it apparently also included at times what seem to have been selective and seasonal killing and sacrifice, either of the image, in rite, or of the real animal. The complexity and interrelation of these storied meanings cannot easily be explained by any generalized theories propounding concepts of hunting magic, fertility ritual, or sexual symbolism. Instead, the art and symbol suggest a broad range of cognitions, cultural and practical, and a profound understanding of processes of nature and of the varieties of living creatures.<sup>96</sup>

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<sup>95</sup> Marshack, Roots, 197.

<sup>96</sup> Marshack, Roots, 260-1.

Matters grew even more complex as the mixture of art, symbol, rite, and story were expressed in increasingly complex visualizations. “Art and symbol are products that visualize and objectify aspects of a culture and no one image in human art is ever entirely explicable in terms of that representation and the limited meaning of that one image.” Even so, Marshack was able to discern “certain tendencies” emergent from the complex Upper Paleolithic art and notation that constitute an intelligible whole, a structured continuity and periodicity that expressed an important aspect of the cultural life of the Upper Paleolithic hunter, namely the necessity of integrating human life with the observable cosmic rhythms.<sup>97</sup> These observations were not, Marshack said, abstract speculations. We can be confident that Upper Paleolithic humans made close and accurate observations of animals and “had a sense of the interrelationship of all phenomena” because “aspects of his stories and knowledge appear in his art.”<sup>98</sup>

Marshack then illustrated his general insight with reference to female images, the famous “Venuses” of the Upper Paleolithic, and suggested various storied accounts of what they may have meant –not to indicate that his interpretation was “correct” in detail but to show that some such story was an event that “included characters (whether spirit, god, hero, person, ‘mana,’ or, in modern

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<sup>97</sup> Marshack, Roots, 275-7.

<sup>98</sup> Marshack, Roots, 282.

terms, element, particle, force or law) who change and do things in time,” and that humans participate in such stories by their imagination. For example, an engraved bas-relief on a reindeer bone from Laugerie Basse, near Les Eyzies, shows a pregnant female human prone beneath a bison in an apparent attitude of supplication or prayer.

The attitude of prayer, the subsidiary position of the woman in relation to the animal, the stage of the pregnancy, the realistic decoration she wears, and the relation of this image to other Magdalenian images of men around animals in ceremonial attitudes or positions seem to imply that this is a “real” woman and not a goddess. If this is a representation of a pregnant woman in storied relation to a male animal, then whether it has to do with a prayer for safe delivery or is the depiction of a myth in which the goddess is also involved with the stag or bull is not really important. For the prayer by a real woman, depicted on a composition for “magical” purposes, is the telling of a mythical story in which animal and women are related: these are acts of participation. The precise story details may be different in the myth of the goddess and the ritual of a pregnancy, yet the basic cognitive uses of story would be similar. For this reason, the stories elements in the composition may be seasonal or celestial, depicting the story of a sky god in relation to an earth goddess, and still the composition could at the same time represent the participation of a real pregnant woman in supplication or ceremony with a real animal. The details are not important in this early stage of interpretation. What is important is that we establish the range and potential of the uses of story and symbol, rite and art, and that we place the evidence in a frame within which analysis and comparison can begin.<sup>99</sup>

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<sup>99</sup> Marshack, Roots, 321-2.

With the end of the Pleistocene a great deal changed in Europe, North Africa and the Middle East. “Not only did man’s way of life in these regions change, but his images and stories also shifted and changed.” The art was still time-factored but the skill in rendition had declined. “For one thing, the 25,000 year old tradition of bone use had suffered when the herds died; for another, the social structures and ceremonial life of which the art had been a part had also deteriorated.” But not everything changed. “The periodicities of sky and season remained and the processes of the human group remained as well.” And so did human cognitive abilities, the tradition of notation and symbol-making, lunar and solar observation and the observation of natural periodicities, rhythms, and habits. “Man retained the ability to function in a complex, time-factored reality by use of symbol and the equations of story.”<sup>100</sup> Human beings did so, moreover, aware that they were “minority creature[s] in the world of nature.”<sup>101</sup> In the decades following the publication of The Roots of Civilization Marshack continued to publish his analysis of specific artifacts but, as has been indicated in the foregoing discussion, he also reflected on larger questions of human cultural evolution. These problems are discussed in the following chapter.

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<sup>100</sup> Marshack, Roots, 340.

<sup>101</sup> Marshack, Roots, 374.