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PERSPECTIVE

Did Monkeys Make the Pre-Clovis Pebble Tools of Northeastern Brazil?

Stuart J. Fiedel

Louis Berger U.S., Inc., Needham, MA, USA

ABSTRACT

Brazilian capuchin monkeys use pebbles as tools for diverse tasks and thus unintentionally create flakes resembling those made by ancient hominins. Capuchins have been using tools in the Serra da Capivara National Park for at least 700 years, and they may have been using tools for more than 100,000 years. Monkeys now flake pebbles near the rockshelters where crude quartzite tools have been cited as evidence of a human presence more than 50,000 years ago. These "tools" may be geofacts created by water and gravity; they may be artifacts made by incredibly conservative pre-Clovis humans; or, they may have been made by the ancestors of today's tool-using monkeys.

KEYWORDS

Capuchin monkeys; pebble tools; Brazil; pre-Clovis; Pedra Furada

At a conference in Mexico City in 2004 I met Fabio Parenti, who had co-directed excavations at the Boqueirao da Pedra Furada in 1987 and 1988. He kindly provided me with a copy of the published version of his 1993 dissertation on the site's stratigraphy, chronology, and lithic assemblages (Parenti 2001). Parenti impressed me as a careful and judicious researcher, with years of experience in analysis of European Paleolithic sites and tools. I could not casually dismiss his attribution of the Pedra Furada pebble tools to humans. As I examined the line drawings of purported artifacts in his monograph, it seemed to me that, while many were readily explicable as geofacts, a minority with multiple flake scars were very difficult to attribute to any natural processes (e.g., Parenti 2001, plates 54, 59, 65, 66, 67, 69, 74, 94). Was it possible that these really were human-chipped tools, some as old as 50,000 years?

I allayed my unease with two considerations. First, an illustrator may exaggerate or misinterpret flake scars; perhaps these pieces would not appear so artifact-like if actually handled. And, as Meltzer, Adovasio, and Dillehay (1994) had observed after they visited the site and examined some putative artifacts, conditions at Pedra Furada were such that, given enough time, the intermittent tumbling of quartzite cobbles down waterfalls ("chutes") from the plateau above the shelter could have produced a few tool-like geofacts. Yet, Parenti countered that he had examined a few thousand cobbles recently fallen down the chutes, but had observed no multiply chipped specimens. He and his Franco-Brazilian colleagues (Guidon et al. 1996) further asked how chipped stones could have been transported away from

the piles at the bottom of the chutes to locations meters away, if not by human action. Meltzer, Adovasio, and Dillehay (1994) resorted to a statistical argument. Parenti had not been able to look at the gravity-induced fracturing process over a long enough time span; in the course of 50,000 years, even if only a tiny fraction of many thousands of cobbles incurred multiple fractures, this would account for the several hundred tool-like pieces selected by Guidon and Parenti.

Niède Guidon and her Franco-Brazilian team have persisted for three decades in claiming that Pedra Furada and several other nearby rockshelters (Vale da Pedra Furada, Toca da Tira Peia, Toca do Sitio do Meio) in the Serra da Capivara National Park in Piauí (northeastern Brazil) were occupied many millennia prior to Clovis (and the related, ubiquitous Fell I fishtail horizon of South America) (Aimola et al. 2014; Boëda et al. 2014; Guidon and Delibrias 1986; Guidon et al. 1996; Guidon, Pessis, and Martin 2009; Lahaye et al. 2013; Santos et al. 2003). Aimola et al. (2014) pointedly observe that there are no waterfalls at Sitio do Meio, where early occupations are now claimed (in this journal) to date between 35,000 and 27,000 cal yr BP (Boëda et al. 2016). The "artifacts" at all these sites are similar, however – fractured pebbles of quartz and quartzite. No sites contain preserved organic materials that would indicate the subsistence patterns of the inhabitants, but they do contain charcoal concentrations interpreted by the excavators as hearths (but dismissed as natural, wind-blown deposits by Meltzer, Adovasio, and Dillehay 1994). This charcoal has produced numerous Pleistocene-age radiocarbon dates.

Already in 1997 Andre Prous had cited anecdotal evidence of Brazilian monkeys hurling rocks at intruders, and suggested that rocks thus thrown from the top of the Pedra Furada cliff might have fractured into pseudo-tools (Prous 1997). In a caustic review of Prous's article, Guidon (1997, 229) dismissed this idea, while reporting that she had seen, in the Serra da Capivara National Park (where Pedra Furada is located), stones left under trees where monkeys had used them to crack nut shells. She attributed these to *guaribas*, or howler monkeys. Guidon contended, however, that these stones were not found in rockshelters or near the putative hearths at Pedra Furada: "It is therefore superfluous and childish to state that stone can flake when falling down a chute or when thrown by monkeys from on high" (Guidon 1997, 229). She argued that the Pedra Furada flaked pebbles were indistinguishable from African pebble tools that were universally accepted as human-made, even when discovered outside of stratified contexts (Guidon 1997, 230). Guidon et al. (1996) also dismissed the waterfall explanation advanced by Meltzer, Adovasio, and Dillehay (1994) as equally "ridiculous."

In March, 2013, I was asked to comment on the most recent claims of ca. 22,000-year-old occupation of the Serra da Capivara (Lahaye et al. 2013). I suggested that, while the chipped quartzite pebbles could be geofacts, some of them might have been made by capuchin monkeys (Bower 2013). Before an audience at the October, 2013 "Paleoamerican Odyssey" conference in Santa Fe, Tom Dillehay derided this suggestion. I later reiterated this idea in an interview with a *New York Times* reporter from Brazil (Romero 2014). Dillehay also was interviewed for the *Times* article, and was quoted as saying, "Fiedel does not know what he is talking about. [...] To say monkeys produced the tools is stupid." Dillehay also was quoted as regarding the Brazilian "tools" as resembling his "tools" from Monte Verde (Romero 2014, A5).

Evidently, by 2013 Dillehay had disavowed his previous interpretation of the Brazilian lithics as geofacts (Meltzer, Adovasio, and Dillehay 1994). In a chapter in the "Paleoamerican Odyssey" volume, he explicitly mentions the "Vale do Meio" [*sic*] lithics as early examples of a putative widespread South American "Edge Trimmed" tool tradition (Dillehay 2014). What accounts for this shift? In 2013 Dillehay had returned to the vicinity of Monte Verde, where he excavated test units and cores along Chinchihuapi Creek. In 2015 he reported the discovery of putative occupations along the creek dating from at least 18,500 and probably 25,000 cal yr BP (Dillehay et al. 2015). If there is a comparably primitive and even older lithic industry in Brazil, the claimed occupation of Monte Verde at such an early date will appear less anomalous and more credible.

By 2013 primatologists had been publishing reports of capuchin stone tool use for more than two decades (de A. Moura and Lee 2004; Westergaard and Fragaszy 1987; Westergaard and Suomi 1995). Particularly noteworthy are observations of tool use in the Serra da Capivara park, just a few stone's-throws away from the supposed pre-Clovis sites (Fragaszy et al. 2004; Mannu and Ottoni 2009; Ottoni and Izar 2008). The monkeys use quartz and quartzite cobbles in various ways:

Stones were mostly used as "hammers" — not only to open fruit or seeds, or smash other food items, but also to break dead wood, conglomerate rock, or cement in search of arthropods, to dislodge bigger stones, and to pulverize embedded quartz pebbles (licking, sniffing, or rubbing the body with the powder produced). Stones also were used in a "hammer-like" fashion to loosen the soil for digging out roots and arthropods, and sometimes as "hoes" to pull the loosened soil. In a few cases, we observed the re-utilization of stone tools for different purposes ($N=3$), or the combined use of two tools — stones and sticks ($N=4$) or two stones ($N=5$), as sequential or associative tools. On three occasions, the monkeys used smaller stones to loosen bigger quartz pebbles embedded in conglomerate rock, which were subsequently used as tools. (Mannu and Ottoni 2009, 242)

Now, Haslam et al. (2016b) report that they have excavated stones with residues of cashew nuts, demonstrating that the Serra da Capivara capuchins have been smashing nut shells with cobbles for at least 700 years. They also have observed that, when the capuchins batter rocks on other rocks, they unintentionally create sharp-edged flakes (which they do not use); the resulting cores and flakes are indistinguishable from the oldest presumptively hominin-created pebble tools in East Africa (the pre-Oldowan Lomekwian industry) (Proffitt et al. 2016). A widely available video linked to the new *Nature* article shows a capuchin smashing quartzite cobbles that it has pulled out of a pebbly conglomerate that uncannily resembles the cobble deposits at Pedra Furada (e.g., <http://www.livescience.com/56546-capuchin-monkeys-accidentally-make-stone-tools-raw-video.html>).

Around 12,400 cal yr BP a new, unmistakably human-made lithic industry called Serra Talhada appears in the Serra da Capivara rockshelters. These well-made chert tools, mainly unifacial, appear to be a local facies of the widespread Itaparica technocomplex (Lourdeau 2015). Their contrast with the older putative quartzite pebble tools is stark. Guidon's team acknowledges this abrupt change, but they have offered no credible explanation for it. It cannot be associated with the changes in skull shape earlier interpreted by Walter Neves and his associates (e.g., Neves and Hubbe 2005) as signifying the

replacement of an original Australo-Melanesian-related Brazilian population by a later wave of Mongoloid people. The dates are all wrong; those cranial changes occurred in the mid-Holocene (Hubbe et al. 2014). So, if there were pre-Mongoloid people in Brazil, they were making the Serra Talhada chert tools, not the pre-12,400 cal yr BP pebble tools. Guidon has speculated (e.g., in a 2008 interview (Pivetta 2008)) that the pebble tools may have been created by African *Homo sapiens*

who rafted across the Atlantic to Brazil about 100,000 years ago. However, any emigrants leaving West Africa between 100,000 and 50,000 years ago would have been carrying mostly Middle Stone Age tools made by Levallois flaking techniques – although quartzite pebble tools are also found at some MSA sites (Soriano, Rasse, and Huysecom 2010).

In any case, new genomic data and analyses indicate that a single wave of people from northeast Asia rapidly



Figure 1 Map of South America showing general distribution of tufted capuchin monkeys (shaded green), capuchin monkey spontaneous stone tool sites (white circles), major archaeological sites (red circles), and fishtail point sites (black squares): 1, Boqueirão da Pedra Furada; 2, Sítio do Meio; 3, Toca da Tira Peia; 4, Pedra Pintada; 5, Santa Elina; 6, Lapa do Boquete; 7, Santana do Riacho; 8, Monte Verde (adapted from Lahaye et al. 2013; Loponte, Okumura, and Carbonera 2016; Ottoni and Izar 2008; Proffitt et al. 2016).

colonized the Americas after 16,000 cal yr BP (Llamas et al. 2016; Raghavan et al. 2013, 2015; Skoglund and Reich 2016). All the living native peoples of Central and South America are descended from the founding Clovis population, as represented by the genome of the Anzick infant (Rasmussen et al. 2014). The new evidence implies that any people who might have been living in northeastern Brazil or southern Chile before 22,000 cal yr BP were replaced and/or swamped by the Clovis descendants who made fishtail points (for new finds of fish-tail points in Brazil, see Loponte, Okumura, and Carbonera 2016). Those pre-Clovis phantoms left no genetic legacy.

So, we are left with three alternative explanations of the multiply-flaked quartzite pebbles of the Serra da Capivara: (1) they are geofacts produced by the actions

of gravity and water power; (2) they were made over the course of 35,000 years by an incredibly conservative *Homo sapiens* population, of mysterious origin, that suffered both cultural and genetic extinction at 12,500 cal yr BP; or (3) they were tools used for varied functions by capuchins and perhaps, other monkeys, some of which may have disappeared in the terminal Pleistocene extinction event.

It is now established that the capuchins have been using stone tools near Pedra Furada for at least 700 years, but one can only speculate how much further back in time this tool-using tradition might extend. Macaques in Thailand also use stone tools (Haslam et al. 2016a), so the mental and manual capacities for tool use could well have evolved in the basal anthropoids, some 45 million years ago, before the divergence of Old and

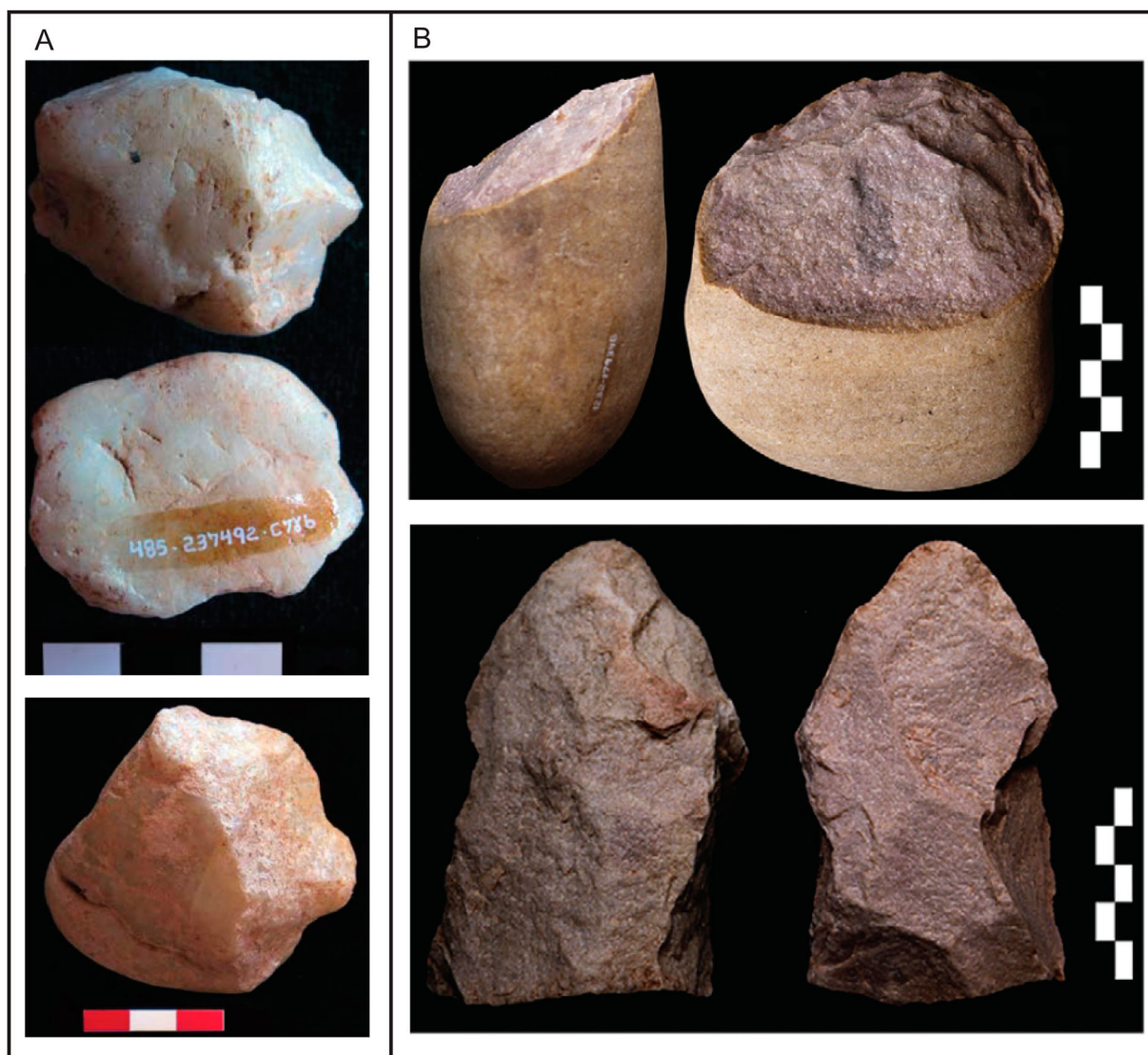


Figure 2 Pebble tools from Pre-Clovis sites in Brazil: A, Vale da Pedra Furada artifacts (from Lahaye et al. 2015, online supplemental materials; reprinted with permission from Elsevier, *Quaternary Geochronology*, Copyright 2015); B, Toca da Tira Peia artifacts (from Lahaye et al. 2013; reprinted with permission from Elsevier, *Journal of Archaeological Science*, Copyright 2013). Scale bars are 1 cm.

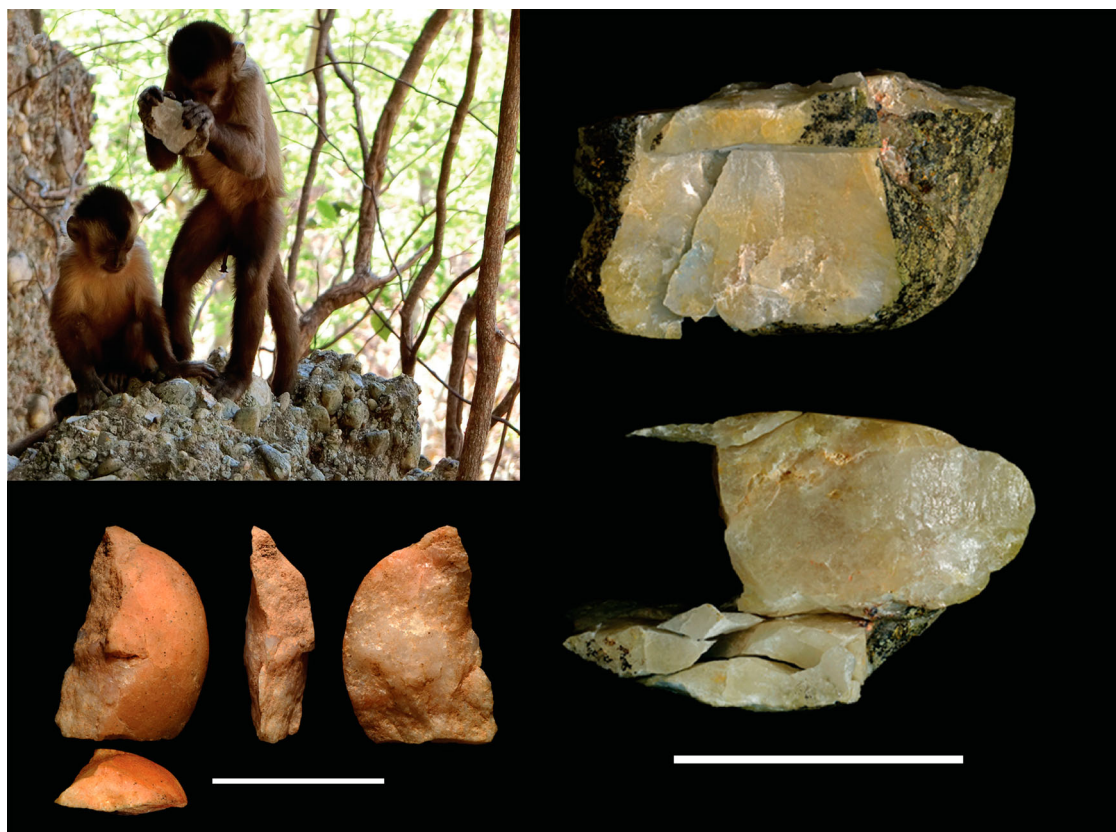


Figure 3 Tufted capuchin monkeys working with stone at OIT1 and OIT2 (top left) and monkey-flaked quartz nodules (from Proffitt et al. 2016; reprinted with permission from Macmillan Publishers Ltd., *Nature*, Copyright 2016). The nodule on the right shows re-articulated flakes. Scale bars are 5 cm.

New World monkeys. The Cebidae family, which includes the various capuchin species, is now estimated to have emerged around 22–25 million years ago (Bloch et al. 2016). Genetic evidence indicates that robust and gracile capuchins diverged about 6 million years ago. The robust (*Sapajus*) clade, which includes the tool-using bearded capuchins, seems to have radiated from an original habitat zone on the Atlantic coast between 500,000 and 125,000 years ago (Lynch Alfaro et al. 2012). Lynch Alfaro et al. (2012, 284) speculate that the “tool use and cultural traditions observed in modern *Sapajus* have also been an important determining factor in their past ability to expand into and across the Cerrado.”

A recent news release quotes Haslam raising another intriguing possibility:

[...] the possible influence of monkeys’ tool use on human behaviour. For example, cashew nuts are native to this area of Brazil, and it is possible that the first humans to arrive here learned about this unknown food through watching the monkeys and their primate cashew-processing industry. (University of Oxford 2016)

Perhaps, the continued occurrence of some quartzite choppers alongside the finer chert tools of the Serra Talhada phase, adduced by Guidon as evidence of cultural

continuity, represents humans’ use of tools imitative of the monkeys’ nut-smashers (or, alternatively, intermittent visits to the shelter by monkeys when humans were absent). Another favorite food of the monkeys is palm nuts. Might the very early harvesting of these nuts by Brazilian Paleoindians (e.g., at Pedra Pintada (Roosevelt et al. 1996) and in the Lagoa Santa rockshelters (Prous and Fogaça 1999)) also be the result of their observation of monkeys’ processing behaviors?

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Disclosure statement

No potential conflict of interest was reported by the author.

Notes on Contributor

Stuart J. Fiedel is senior archaeologist with Louis Berger U.S. He earned his PhD in Anthropology at the University of Pennsylvania in 1979, and since then has published extensively in peopling of the Americas, linguistics and archaeology, and heritage resource management. Among his publications is the book *Prehistory of the Americas* (Cambridge University Press 1992).

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