RESEARCH NOTE

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How Ancient Is Lore?
Southeast Asia Speaks Up

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The idea that the sky is made out of stone appears in folk and religious traditions all around our planet. I have discussed this idea, and briefly proposed that another idea—the "stone falling from sky" motif—offers a key to understanding the wide distribution of the "sky of stone" (Metevelis 2000).[1] Stones do indeed fall down from the sky all the time. Occasionally people see them fall, even collect them from strewnfields while their brimstony rinds are still hot and smelly from atmospheric passage.

In fact, *Homo* has been witnessing skyfall events since before he was *sapiens*. Not only minor meteorite falls, which were amazing enough. Very massive stones also were coming out of the sky, and these were producing dramatic spectacles. To demonstrate this point, I need only adduce the Australasian Strewnfield, the youngest known strewnfield of tektites[2] on Earth, and by far the largest. It covers one-tenth of Earth's surface (5×10^7 km^2), extending from east of Australia westward to Madagascar, and across Malaysia and the Philippines to Pacific regions south of Japan.[3] It also includes microtektites recovered in oceanic sediment cores.

The tektites of this strewnfield are determined radiometrically to be about 780,000 years old (783 ± 21 ka and 784 ± 12 ka); so they fell to ground at the Early/Middle Pleistocene boundary, just before the most recent (Brunhes/Matsuyama) geomagnetic reversal. This means they fell while *Homo erectus* populations were stalking about Southeast Asia with a well-made stone tool in one hand and already a firebrand in the other.[4] What a spectacle these antique peoples must have beheld on the fateful day the Australasian tektites fell among them! It was sudden, intense, and awesome beyond their experience. What could they make of myriad strange fires plunging through the sky, sonic booms wildly assailing the cosmos all about, and volleys of hot grapeshot whizzing into the ground? This was such a great spectacle engulfing so vast a territory that our Southeast Asian predecessors—population group after population group—simply had to take notice of what was befalling them. It ought to have left pockets of survivors dumbfounded, earnestly wondering about their experience. It ought to have been a major event in human prehistory.

The Bose basin of South China, near the border with Vietnam, affords us a close-up view of the event. There paleoanthropologists have found tektites 803,000 ± 3000 years old—probable members of the Australasian Strewnfield, since their location is right and their radiometric ages are concordant within error (Hou et al. 2000; Langbroek and Roebroeks 2000; Gibbons 2000, Bower 2000a, Fountain 2000). The investigators found them mixed in with tool-bearing sediments of twenty-four Acheulian-like stoneworking sites in the basin. The sites all occur on the same fluvial terrace, meaning they belong to the same time period. The concomitance of tools and tektites implies the massive airfall that produced the strewnfield cannot have gone unobserved in the inhabited basin. The investigators also found plenty of charcoal and silicified wood fragments *in situ* at the sites, in the same sediments that contained the tektites and stone tools. Those combustion products imply that, when the tektites dropped into the Bose area, they ignited a forest firestorm. The tektites had hardened from the molten state while in flight, only minutes before they arrived.

Could the two folklore motifs of "falling sun" and "combusting earth" plausibly date from this particular event in ultradeep antiquity?[5] Physically, the high-energy fireball that spawned the storm of Australasian tektites must have been observed over a wide swath of our planet as it bent down from the recesses of the sky. There can be no doubt that the fireball was dazzling. It must have resembled either a sun falling or a sky ablaze. And the tektites it sent out burned up forests. We can presume the widespread firestorms billowed enough smoke to blanket the region of the strewnfield. Multitudes of lives must have been affected.

So the "falling sun" and "combusting earth" motifs do fit with the physical event. But did they originate in it?[6] Not necessarily, and not so simply. Fireball impacts are common enough in nature, and the more energetic of them could do the job without help from tektites—locally.[7] Nevertheless, the Australasian impact event appears to be singularly the most energetic, and is probably by far the most devastating one in all of human prehistory. It alone spewed tektites that afflicted an entire inhabited region (a fact which has gone unappreciated by recent Asianists). In so doing, the event uniquely delivered to the mid-Pleistocene populations of the whole region a remarkable experience *in common*! It plausibly could have contributed to some understandings or ideas becoming widely held throughout the region.

But held for so long? Storms of tektites occur far apart over geologic time, and many reasonable folklorists are likely to think this particular one occurred too early in prehistory to contribute to the pair of motifs, or to the "sky of stone" motif. They might also argue, among other things, that *H. erectus* peoples lacked both symbolic thinking and the communicative ability to transmit a tradition of complex ideas.[8] Yet we should hesitate to claim, without positive evidence,

that *H. erectus* peoples were cognitively crippled. I think we should be wary of underestimating our very close relatives.[9]

One thing is sure: The spectacular storm of Australasian tektites (along with other early sky-events) attracted attention to the truth that some incredibly mysterious activities originate above the trees and mountains. This imposed-awareness of active mystery in the sky is the stuff of lore; it would be preserved in post-impact cultures of the region. I dare suggest it still persisted in the region when *H. sapiens* appeared there—just like traditional wisdom concerning fire using, stone flaking, and tool using did—and throughout the period when the two species of people coexisted in Southeast Asia, currently thought to be 50,000–30,000 BP.

Once aroused, an awareness of mystery in the sky can become self-sustaining, because it is apt to foster ever more observations of sky events in a positive-feedback loop. Maybe even some thought on the upper cosmos (as Albert Einstein said, the mysterious is the source of all true art and science). If any regional ideas concerning sky stones or fireballs should eventually arise, then each new fall of any kind observed in the region, however removed from the last in time or distance, would tend to keep those ideas ever-renewed and unforgotten in lore. Such is the amazement attending all observed skyfalls (FARRINGTON 1900: 207; ÉLIADE 1958: 54, 226–27; BURKE 1986: 72–73, 219; modern examples in *Japan Times* 1991a, 1991b, 1992).

Large and little, meteorites kept on pelting the surfaces of our planet while our species was evolving. And considered from a regional or global (rather than local) perspective, cosmic impacts around occupied areas are not infrequent. How far back through time are we willing to apply a working hypothesis that the worldwide sky-of-stone idea is founded in worldwide observations of meteorite falls? Back to a time preceding the advent of *H. sapiens*? Back to the end of the Late Pleistocene? How ancient is lore? Surely, in any case, ideas related to falling sky-objects do reach us from beyond the long memory of oral tradition.

NOTES

1. In Stith Thompson's *Motif-Index of Folk-Literature* (THOMPSON 1975), the "sky of stone" motif curiously goes unlisted, although the closely related motif, "sky of solid substance" (Motif A669.2) does appear. The motif of a stone falling from the sky appears in Thompson's *Index* as Motif A1009.3. There is also a motif in which the entire sky collapses, crushing people beneath its rubble (for example, HORCASITAS 1988, 195; KÄHLER-MEYER 1988, 251).

2. Mineralogists and meteoriticists consider tektites (from the Greek *tektos*, "molten") to be secondary products of large-scale—hence highly energetic—meteorite impacts. Tektites are instantaneously melted blobs of target rock from Earth's surface that, after cooling, become dark glassy objects resembling volcanic obsidian. The molten blobs spatter from the meteorite's impact site and go into ballistic or suborbital trajectories. After they reenter the atmosphere and slow down significantly, in-flight quenching often

sculpts tektite glasses into sphere, ellipsoid, teardrop, dumbbell, hemisphere, flanged-button, biconvex lens, and other aerodynamic shapes before they land in a distant strewnfield. Many of them, however, solidify into rotund lumps.

Stishovite, coesite, and shocked quartz all occur in association with the Australasian Strewnfield. These minerals and petrographic characteristics are clear indicators that the Australasian tektites indeed are impact ejecta (Glass and Wu 1993).

The Australasian impact splash failed to shed enough heat to save land areas of its strewnfield from receiving incendiary thermal pulses when the glasses arrived. Some of these glasses have *ablation caps*, indicating they re-melted at hypersonic speeds during initial reentry.

3. Its *source crater* must be huge, but it remains unfound at this writing. An early suggestion that the crater is one in Siberia has been disproved. Recent searches for it in northeastern Thailand, Laos, and Cambodia proved unfruitful (Blum et al. 1992; Glass 1993; Hartung and Koeberl 1994; Schneider 1995). It was sought in Thailand again more recently (Bunopas et al. 1999). But it might be submerged on the Sunda Shelf. Curiously, when the volcanic island Krakatou (in the Sunda Strait, between Java and Sumatra) exploded in August 1883, one of the loudest noises in history was heard from the shores of East Africa to Alice Springs in central Australia—roughly the same east-west coverage as the Australasian Strewnfield.

4. Control and use of fire, but not necessarily ignition technology, might date back 1.7 million years (Bower 2000b).

5. "Fall of sun causes world-fire" is Motif A1031.4. This motif mimics what *fireballs* (extraordinarily brilliant meteors) actually do in nature, since fireballs might reach –22 magnitude or greater, rivaling the Sun in both luminosity and apparent size even in daytime. And, like tektites, fireballs reaching Earth's surface might give the ground an incendiary thermal pulse. Many falling-sun tales include the "superfluous suns" theme (for example, Motifs A716.1, A720.1, F961.1.3), the "hyperthermal sun" theme (Motifs A720.2, A727.1, A733.5), and often the ekpyrosis or "world-blaze" theme (Motif A1030). For some examples, see Ho 1967, vol. 1: 33–48, vol. 2: Tales 1–31.

6. I am not trying to be glib with this question. The unexpected Leonid *meteor storm* seen in the eastern United States on 13 November 1833 influenced regional thinking in its time. This event astonished and awed observers, and prompted profound and widespread discussion on just what had happened, and on its origins and meaning. The discussion had two consequences: It inspired the birth of a new science called *meteor astronomy*. It also inspired a religious revival, and a growth of Christian fundamentalism, which still survives in the US.

7. Lest there be doubt in this matter, I present here a selection of five examples. The first I present in greater detail in order to give a feeling for the experience of such events.

On 12 February 1947, near the western spurs of the Sikhote-Aline mountains in Siberia's Maritime Province, several hundred people saw a *bolide* (bursting fireball) shooting from the north across a clear morning sky. Exceeding the Sun in apparent size and brilliance, it cast moving secondary shadows in broad daylight, and dazzled eyes. It changed colors as it went, dropping sparks, some with individual smoky tails. The tails broadened and merged, leaving a single boiling bar of smoke stretched across the sky for hours. The bolide burst moments before impact, but fiery chunks continued flying as a coherent swarm—with small fires pursuing the main one, all encased in a common luminescence (auriole, or glory). After the swarm disappeared behind some hills, booms were followed by a roaring noise. Not long after that, pressure waves shoved observers back on their heels. Within the impact area many trees were uprooted, treetops and branches were severed, and nickel-iron chunks lodged in trunks. Some uprooted trees

were radially oriented to one or another crater, with their tops pointing away from the impact point. About two hundred cavities opened in snowy forest ground within an elliptical zone of 1.6 km^2. The cavities ranged from one to 26.5 meters across and up to 6 meters deep, and were size-graded with the largest at the south (downrange) end. The largest were rimmed craters. Most, however, were small and unrimmed percussion pits. Craters less than about 1.8 meters usually harbored beneath their floors a concentration of iron meteorite chunks that had not shattered on impact. Those over about 3.7 meters held impact-shattered fragments dispersed on and under their floors. The larger the cavity, the greater the fragmentation on impact. Some small chunks blasted cavities in the ground then ricocheted out onto the preimpact surface. A *fall*, by definition, is a witnessed event, but this one-hundred-ton fall is the largest one historically confirmed to have been witnessed. The coolness and dampness of the season probably fireproofed the forest.

The *meteorite shower* producing the Henbury craters near Alice Springs in Northern Territory, Australia, appears to have occurred close to 5,000 years ago. The largest crater in this group is elliptical, measuring 220 by 110 meters, evidently an eroded *multiple crater* (an irregular crater formed by more than one impactor, or by an aerially fragmented one). The local aborigines tell tales of "iron stones" littering the area around the craters. They call the irons "sun-trail-fire-devil-stone," and they avoid the whole area as though the craters were taboo. Their ancient experience appears to have lasted in tradition.

The grazing (low angle) impact of a fireball near Rio Cuarto on the Argentine Pampas "considerably less than 10,000 years ago" left a field of 10 gash-like craters, the largest measuring 1.2 by 4 kilometers, the others successively smaller with distance downrange (Schultz and Lianza 1992). The energy release of about 350 megatons must have grabbed the attention of the predecessors of the Incas living in the distant Andean foothills. The nomadic Indians on the Pampas had it worse when the "impact created a nearly instantaneous mountain of fire that engulfed a tract of grasslands 10 km wide and 50 km downrange within seconds" (Schultz and Beatty 1992).

The Campo del Cielo event occurred 5,800 ± 200 years ago in Gran Chaco Gualamba, in northern Argentina. It left at least a dozen small craters in the ground, ranging from 20 to 100 meters in diameter, and more than 15 tons of iron fragments. The parent object appears to have arrived on a flat trajectory, breaking up aerially and depositing the fragments in an unusually long and narrow strewnfield. The major axis of the crater field coincides with that of the strewnfield, but is much shorter. A charcoal stump discovered under ejecta outside the rim of one of the largest craters allowed the event to be carbon dated, and implies that the event set off a firestorm (Hodge 1994, 55–56). "Campo del Cielo" is a Spanish translation of the aboriginal name *Piguem Nonralta*, "Field of the Sky," which suggests local people observed the impact event as it happened. There is also a South American tale of a stone darting down from the sky to destroy mankind (Motif A1009.3 "Large stone falls from sky killing all but one couple"). This tale looks as if it could derive from the Campo del Cielo impact event (Cassidy et al. 1965; Cassidy and Renard 1966).

An iron object released energy equivalent to the yield of a 15-megaton thermonuclear device when it excavated 175 million metric tons of rock from Barringer Crater on the Colorado Plateau, in northern Arizona. The lone crater is 1.2 kilometers across, and still fresh today. It formed about 50,000 years ago, before paleo-Indians arrived in the area (At the time of impact, the last Neanderthal peoples still inhabited Europe, but were facing extinction; H. erectus was faring about the same in Indonesia). Like with the Alice Springs and Rio Cuarto events, the Barringer impactor's main mass could not survive the hyperhellish heat and pressure of impact; but small, unshocked, recognizable pieces of the impactor were deposited on grounds around the impact site. Many pieces, in fact: perhaps

thirty tons' worth, the largest weighing 639 kilograms. Although some were found as far away as 13 kilometers, most of the unshocked pieces were distributed almost symmetrically within 3 kilometers of the crater's raised rim.

8. But *H. erectus* probably would not be accused of lacking the necessary curiosity—not if the curiosities of even cattle can be piqued by witness of meteorite impacts (*Daily News* 1994; *Sky & Telescope* 1994)!

9. In assessing the abilities of early *Homo*, writers have seemed willing to infer evidence of lack from lack of evidence. But some so-called "modern" human behaviors that formerly were claimed to have emerged ca. 40–50 ka can now be associated with developing African Middle Stone Age technology, and pushed back to 250–300 ka (McBrearty and Brooks 2000). Researchers also now realize that, in Africa, Acheulian handaxes were used for woodworking as early as 1.5 ma (Dominguez-Rodrigo et al. 2001). When it comes to the development of syntactic language, the best that can be said is as follows: "Abstract and symbolic behaviors imply language, but it is doubtful that the point at which they can first be detected coincides with the birth of language. Attempts to identify the earliest signs of language…contribute to a sense of continuity, rather than discontinuity, between human and nonhuman primate cognitive and communicative abilities. Language does not fossilize, and technology provides insight only into the minimum cognitive abilities of its makers and users. *We infer that some form of language originated early in human evolution, and that language existed in a variety of forms throughout its long evolution*, but we concur with those who have pointed out the inherent untestability of many propositions regarding the origin of language, and the profound silence of the archaeological record on this issue" (McBrearty and Brooks 2000: 486, emphasis added).

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