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Steven A. Weber: An Interdisciplinary Visionary in Paleoethnobotany

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In its fortieth year, the Society of Ethnobiology is recognizing one of its founders, Steve Weber, with the dedication of this issue to his career. In addition to founding the Society, Steve has made significant contributions to the field of ethnobiology through his paleoethnobotanical research. The same creative vision that fueled the beginnings of the Society are evident in his research in South Asia.

Steve's research revolutionized understanding of agricultural practices across the Indus Valley region and helped to launch systematic archaeobotanical studies in South Asia. Prior to Steve's research at the site of Rojdi, in Gujarat, in the southern part of the Indus Valley, investigations of plant use were narrow and focused only on the presence or absence of cultivars. There was little concern for how these remains were distributed across sites, how their use changed through time, or what importance they held in the past diets (see discussion in Fuller and Weber 2005). Steve's research agenda set out to broaden the research perspective not only through systematic sampling of plant remains with a flotation machine, but also by applying an ethnobiological lens to the research. That is, he considered cultivated and wild plants to be part of a broader subsistence base that also included livestock and hunted animals.

Steve's engagement with South Asian archaeology was part of a pivotal shift in its history during the 1980s and 1990s. He and a few Indian colleagues moved from simply cataloguing plant remains towards a truly interdisciplinary paleoethnobotanical approach that was at once anthropological and ecological (see historical treatments of the field [Fuller 2002; Pennington and Weber 2004]). In this regard, Steve drew on his experience working in the American Southwest in archaeological science and ethnobotany (e.g., Weber 1986; Whiting et al. 1985)—perspectives that fueled his research in the Indus region.

Steve's research at the site of Rojdi established a model for how to properly integrate paleoethnobotany into the research design of an excavation project (Weber 1992). Steve created sampling strategies that not only targeted most contexts at Rodji, he also floated large volumes of sediment at sites like Harappa (Weber 2003) and Farmana (Weber et al. 2011), which allowed him to provide a comprehensive picture of subsistence in the Indus Valley. To this day, Steve's volume on Rojdi remains the only book published on the paleoethnobotany of a Harappan site (Weber 1992).

Steve's work also shifted perceptions of the role that a suite of small-seeded grasses, collectively known as millets, played in subsistence patterns around the world. Prior to Steve's work, paleoethnobotanical research focused heavily on documenting the domestication, spread, and use of large-grained crops, such as rice (*Oryza* sp.), wheat (*Triticum*), and barley (*Hordeum vulgare*). Because of their small size, differ-

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ent types of millet are often not visible to the naked eye. As Steve pointed out, their contribution to past diets was largely overlooked by researchers who handpicked grains from sediments. By promoting the use of systematic flotation, Steve documented the crucial role that millet played in past subsistence. For instance, Steve's work in Thailand revealed that, rather than rice, the earliest suite of domesticated crops to spread to mainland South East Asia were foxtail millets (*Setaria italica*) (Weber and Fuller 2008; Weber et al. 2010a). Steve also argued for paleoethnobotany to pay attention to the potential role played by these crucial small-seed grass crops in the Americas (Weber and Fuller 2008).

One of Steve's insights was to contrast larger-grained, deep-rooted, and more productive grains—like wheat and barley—that supported urbanism, with smaller-grained resilient millets that propped up local adaptability in smaller communities (Weber et al. 2010b). Steve's work in South Asia also emphasized the important dietary role of plants such as chenopods as wild or cultivated foods (Weber 1992; Weber et al. 2011). Although one of us critiqued Steve's insight contrasting grain crop use in large and small communities (Fuller and Madella 2001:346), increasing evidence from sites throughout Asia (Xue 2010; Yang and Liu 2009; Zhao and Chen 2011) has supported Steve's hypothesis. As in the Americas (e.g., Bruno 2006), the archaeobotany of Asia and the ethnobotany of India indicate that chenopods were an important grain (as well as a leafy green) in diet (e.g., Partap and Kapoor 1985a, 1985b).

In South Asia, the importance of crops like sorghum (*Sorghum* sp.) in historic subsistence patterns led Possehl (1986) to believe that these millets originated from Africa. Steve's research drew attention to the fact that a number of millets were indigenous to South Asia and that African crops were adopted because they fit into the niche already established by indigenous millet cultivation (Jarrige 1985; Meadow 1989, 1991; Possehl 1986; Weber 1998). Previously, researchers had argued that millets became important only towards the end of the Harappan period (roughly 1900 BCE) and had contributed to deurbanization by allowing the settlement of areas where wheat and barley farming could not be supported (see also Jarrige 1985; Meadow 1989, 1991). Using systematically collected data, Steve demonstrated that millets were present at Indus sites from the earliest days of the Harappan civilization (Weber 1990, 1992, 1998). He emphasized that, in the Indus Valley, people experimented with a wide range of regional farming practices: while some areas, such as Gujarat, Haryana, and Baluchistan, were environmentally adapted to millet production, core Harappan sites focused on the production of wheat and barley (Weber 1998, 2003; Weber et al. 2010c).

Steve's research also demonstrated that the decline of Harappan urban society was not accompanied by a major change in subsistence practices, but by strategic shifts along a continuum of emphasis on two seasons of cultivation. Flexible and environmentally attuned cultural practices developed over millennia continued across the regions (Weber 1998, 1999, 2003). This flexibility is still evident today, as large parts of northern South Asia are characterized by two different farming regimes: a) the *rabi* (winter) cultivation season that focused on crops originally domesticated in Southwest Asia, such as wheat, barley, lentils (*Lens* sp.) and peas (*Pisum* sp.); and b) a *kharif* or summer cultivation system that focused on millets. This flexibility has deep temporal roots and was particularly characteristic of small sites that were peripheral to the Harappan core—places that showed continuity after urbanism declined. More recent scholarship has continued to flesh out how such agricultural flexibility through the two seasons provided adaptability, even in the face of shifting climatic conditions (e.g., Giosan et al. 2018; Petrie and Bates 2017); these recent interpretations follow a path laid by Steve's research.

Steve called for nuance in describing past Harappan farming systems, as well as for moving beyond simple characterization of regions as based on either *rabi* (winter) or *kharif* (summer) systems of farming. He argued that researchers should delve into more precise characterizations of the local agro-ecology that demonstrate the nuances of more complex systems of cropping (Weber et al. 2010c). Steve's scholarship (Weber et al. 2011), and that of the students (Meyer 2003), incorporated ethnographic methods into paleoethnobotanical research design, allowing him to more comprehensively interpret the combined impacts of local environment, cultural practices, and resulting human-environmental interactions. While previous research considered only widespread patterns of rainfall, Steve's careful use of an agro-ecological model at Lothal, Mohenjo-Daro, and Harappa demonstrated that the inhabitants of these sites adapted their farming regimes to manage not only rainfall but complex differences in river load, sedimentation, and overflooding, as well as varying potentials for irrigation (Weber et al. 2010c). Likewise, his work at the site of Farmana demonstrated that, often, these two systems of farming could overlap and be practiced at a single site, as farmers varied the proportions of crops they farmed over time (Weber et al. 2011).

True to the legacy of the Society of Ethnobiology that he co-founded, Steve was not content to simply document past uses of South East Asian crops but rather emphasized the potential they hold for future food security. The perception that grain crops, such as millet, might not be as productive as better-known staple crops, has led breeders, agronomists, and economists to focus efforts on making the big four grain crops (rice, wheat, corn [*Zea mays*], and barley) more drought and heat tolerant. In contrast, millets have been relegated to minor roles in contemporary agriculture. Indeed, as Steve pointed out, some millets, such as *Panicum sumatrense*, might soon be forgotten (Weber and Kashyap 2014). However, many types of millet are more nutritious than some large seeded alternatives and are also better adapted to high heat and low rainfall conditions (Weber and Fuller 2008; Weber and Kashyap 2014). Steve called for millets to be taken seriously by agronomists, particularly in the face of climate change, and his work has highlighted how attention to past plant use, revealed through paleoethnobotany and ethnobotany, offers useful lessons to be heeded in the future of agriculture.

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