Savanna chimpanzees dig for food

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Professor Toshisada Nishida wrote "chimpanzees are always new to me" (1) almost 15 years ago, but his statement still holds. Far from exhausting the breadth and depth of chimpanzee behavior, even when there are more long-term field studies than ever before, field primatologists studying *Pan troglodytes* continue to report new discoveries. Moreover, some of these findings, such as that of the spear-hunting chimpanzees of Fongoli, Senegal (2), are so unexpected that they make popular as well as scientific news. Likely to make similar waves is the report by Hernandez-Aguilar *et al.* (3) in this issue of PNAS that wild chimpanzees use digging tools to harvest plant underground storage organs.

One reason for the prominence given to these new data is their origin: another hot, dry, and open ecotype, in this case the savanna woodland ("miombo") of the vast Ugalla region of western Tanzania (Fig. 1). (This little studied, unprotected area is adjacent to, but separated by mountains from, the famous Mahale Mountains National Park on the eastern shore of Lake Tanganyika.) As with other recent reports, including the bush baby-skewering apes cited above, it is these wide-ranging, open-country apes who are extending the behavioral repertoire of humankind's closest living relations. Recent examples are the cave-using chimpanzees of Fongoli (4), the anvil-using chimpanzees of Assirik, Senegal (5), and the well-digging chimpanzees of Semliki, Uganda (6). All of these populations, whether in East or West Africa, inhabit marginal areas at the limits of the species' distribution, where the limiting environmental factors are low rainfall (most have prolonged totally dry seasons of several months) and lack of cover (most are mosaic habitats where $<5\%$ of surface area is evergreen vegetation).

Although there have been brief descriptions of chimpanzees eating roots before (e.g., ref. 7), and although other species of primates (e.g., savanna baboons) regularly eat the underground corms of grasses (8), no previous reports of apes enlisting elementary technology to unearth these resources have appeared until now. Interestingly, the only other report (also brief) of such extractive foraging also comes from primate populations living on the edge of a forest-dwelling species' range, in this case the capuchin monkeys in the dry Brazilian "cerrado." They use "trowels" of stone to dig up roots (9). The key is the employment of a simple tool to gain access to a high-energy foodstuff that would otherwise be locked in the substrate. That such dietary items are of longstanding nutritional significance to chimpanzees is indicated by the discovery made by Mercader *et al.* (10) of starch grain residues on percussive tool fragments excavated from 4,300-year-old strata in West Africa. Thus, a material culture focused on starchy carbohydrates is now a reality and adds weight to speculation about its evolutionary origins (11).

Fig. 1. A savanna chimpanzee sits atop a termite mound and contemplates the landscape of Fongoli, Senegal (photograph by Paco Bertolani, Leverhulme Centre for Human Evolutionary Studies).

Why has it taken so long to acquire such basic knowledge of diet in savanna chimpanzees? The answer is not that we lack the knowledge that chimpanzees survive in such places: Ninety years ago, Garner (12) reported chimpanzees crossing open landscapes in Gabon. More likely, it is because such ape populations are wide-ranging and therefore hard to find and follow; this makes habituation (a jargon term for persuading free-ranging primates to tolerate observers at close range) difficult for field workers to achieve. Indeed, the first savanna population to be habituated (and without provisioning of food rewards) was at Fongoli only in 2005 (4). Early, promising surveys by pioneers like Jim Moore (13) finally have led to intensive ecological and ethological investigations, and more unexpected findings are on the way.

Non-devotees of chimpanzees may wonder what the fuss is all about. Did not Jane Goodall tell us more than 40 years ago that chimpanzees were fascinating and intelligent creatures? How much more do we need to know about these apes? Three major points may explain their enduring fascination. One is that across Africa, from Senegal to Tanzania, chimpanzees are highly endangered. Whether the cause of mortality is direct (hunting for bushmeat, spread of infectious disease) or indirect (deforestation for timber or agriculture), chimpanzee populations inexorably shrink, just as their human neighbors expand. We are in a race against time to find out about this intelligent, popular species.

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Another point dovetails with the first: We now know that chimpanzee behavior varies at a variety of levels, across individuals, kinship lineages, groups, and populations. This variation cannot be explained by genetic (e.g., ref. 14) or environmental (e.g., ref. 15) factors but instead seems to stem from cultural diversity. Thus, it is no longer enough for conservation efforts to focus on the species as a whole; instead, we need to encompass a range of populations within a species. If we wish to know about cultural variation in chimpanzees, then we must save populations threatened by local extinction. For example, the tuber-eating chimpanzees of Tongo, first described by Lanjouw (7), may now be gone forever, having had the bad luck to be in the middle of a Congolese war-zone.

The final reason for our compelling interest in savanna chimpanzees is a self-serving one. Many of us were taught from textbooks that presented the grasslands of East Africa as humanity's cradle, the crucible in which the Last Common Ancestor of living apes and humans stood up on his legs and became us (e.g., ref. 16). That scenario is no longer so simple, but its attraction is abiding. Short of inventing a time machine, we will never see our hominin ancestors in action, and the direct evidence for their lives is likely to continue to be the fragmentary stones and bones of the archaeological and palaeontological records. To supplement these sparse data, we still have access to a living large-brained, technological, hunting-and-gathering cousin who is as close to us genetically as a wolf is to a dog. Even the simplest findings can change our views of our own evolution—for example, the data of Hernandez-Aguilar *et al.* (3) show that the Ugalla chimpanzees use tools to dig up roots, not in the lean times of the dry season, but in the relatively more abundant wet season. Could this be because their crude tools are not crafted from stone scrapers or hardened by fire to become the more efficient digging sticks used by open-country foraging peoples today (17)? Such issues call for actualistic experiments *in situ* (e.g., ref. 18), in collaboration with archaeologists and behavioral ecologists.

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1. Nishida T (1993) in *The Great Ape Project*, eds Cavilieri P, Singer P (Fourth Estate, London), pp 24–26.
2. Pruetz JD, Bertolani P (2007) *Curr Biol* 17:412–417.
3. Hernandez-Aguilar RA, Moore J, Pickering TR (2007) *Proc Natl Acad Sci USA* 104:19210–19213.
4. Pruetz JD (2005) *Am J Phys Anthropol* 126(Suppl 40):168.
5. McGrew WC, Baldwin PJB, Marchant LF, Pruetz JD, Scott S, Tutin CEG (2003) *PaleoAnthropology* 1:1–20.
6. Hunt KD, McGrew WC (2002) in *Behavioural Diversity in Chimpanzees and Bonobos*, eds Boesch C, Hohmann G, Marchant LF (Cambridge Univ Press, Cambridge, UK), pp 35–51.
7. Lanjouw A (2002) in *Behavioural Diversity in Chimpanzees and Bonobos*, eds Boesch C, Hohmann G, Marchant LF (Cambridge Univ Press, Cambridge, UK), pp 52–60.
8. Norton GW, Rhine RJ, Wynn GW, Wynn RD (1987) *Folia Primatol* 48:78–120.
9. Moura ACA, Lee PC (2004) *Science* 306:1909.
10. Mercader J, Barton H, Gillespie J, Harris J, Kuhn S, Tyler R, Boesch C (2007) *Proc Natl Acad Sci USA* 104:3043–3048.
11. Wrangham RW, Jones TH, Laden G, Pilbeam D, Conklin-Brittain N (1999) *Curr Anthropol* 40:567–594.
12. Garner RL (1918) *NY Zool Soc Bull* 21:1566–1567.
13. Moore J (1996) in *Great Ape Societies*, eds McGrew WC, Marchant LF, Nishida T (Cambridge Univ Press, Cambridge, UK), pp 275–292.
14. Lycett SJ, Collard M, McGrew WC (2007) *Proc Natl Acad Sci USA* 104:17588–17592.
15. McGrew WC, Ham RM, White LJT, Tutin CEG, Fernandez M (1997) *Int J Primatol* 18:353–374.
16. Rasmussen DT (1993) *The Origin and Evolution of Humans and Humanness* (Jones and Bartlett, London).
17. Marlowe FW (2005) *Evol Anthropol* 14:54–67.
18. Matsuzawa T (2006) in *Cognitive Development in Chimpanzees*, eds Matsuzawa T, Tomonaga M, Tanaka M (Springer, Tokyo), pp 3–33.