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# 30,000-Year-Old Wild Flax Fibers

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Here, we report an identification of wild flax fibers from a series of Upper Paleolithic layers at Dzudzuana Cave, Georgia (1, 2), indicating that prehistoric hunter-gatherers were making cords for hafting stone tools, weaving

We found the flax fibers during analyses of 86 clay samples of 50 g each collected from five locations within the excavated area in 2007 and 2008 (table S2). The clay deposits are rich in carbonate and produced large amounts of nonpollen palyno-

All 27 clay samples from unit D produced fibers of flax ( $N = 488$ ) (table S2); some were spun ( $N = 13$ ) and dyed ( $N = 58$ ), the colors are mostly black-to-gray and turquoise. One of the threads is twisted. The complete fibers are long ( $>200\text{-m}$ ) and composed of segments of smaller lengths. Individual fibers are linear with thin and translucent walls. Several ends of both complete and disbanded fibers were cut across (Fig. 1, 1 to 7).

We recovered 787 fiber fragments of various lengths from unit C. The highest concentration was in sublayer C-5 (table S2). A few fibers were spun ( $N = 18$ ), and one string had numerous knots (unit C-3). We found 38 colored fibers: black, gray, turquoise, and a pink one.

Fewer flax fibers were found in all seven samples of unit B ( $N = 48$ ; only three of which were colored, one black and two turquoise) and in five samples of unit A ( $N = 30$ ) (table S2).

Several samples from unit C appear to be twply S-twisted in a relatively complex pattern (Fig. 1, 8 to 12). The colored fibers may indicate that the inhabitants of the cave were engaged in producing colorful textiles. We also recovered a few tur hairs in unit D, including colored and twisted ones (fig. S1). The combination of flax fibers, some tur hair, and microremains of skin beetles (fig. S2) and moth can be interpreted as an evidence for processing of fur, skin, and cloth. This conclusion is supported by the presence of spores of the *Chaetomium* fungus (fig. S2), usually growing on clothes and other textiles and unfortunately destroying them (6).

## References and Notes

1. T. Meshveliani *et al.*, in *The Early Upper Paleolithic Beyond Western Europe*, P. J. Brantingham *et al.*, Eds. (Univ. of California Press, Berkeley, 2004), pp. 129–143.
2. Materials and methods are available as supporting material on Science Online.
3. J. M. Adovasio *et al.*, *Archaeol. Ethnol. Anthropol. Eurasia* **2001**, 48 (2001).
4. D. Nadel *et al.*, *Curr. Anthropol.* **35**, 451 (1994).
5. A. A. Grossgeim, *Rastitel'nye resursy Kavkaza (Plant Resources of the Caucasus)* (The Academy of Sciences of Azerbaijan SSR Press, Baku, Azerbaijan, 1946).
6. B. Van Geel, A. Artroot, *Nova Hedwigia* **82**, 3 (2006).
7. The American School of Prehistoric Research, Peabody Museum, Harvard University, funded this project; J. P. Wild helped in the identification of flax, cotton, and wool fibers; D. Lordkipanidze, I. Koridze, and G. Bar-Oz provided assistance; and D. Pilbeam, C. Brezine, and anonymous reviewers provided valuable comments.

## Supporting Online Material

www.sciencemag.org/cgi/content/full/325/5946/1359/DC1

Materials and Methods

Figs. S1 to S4

Tables S1 and S2

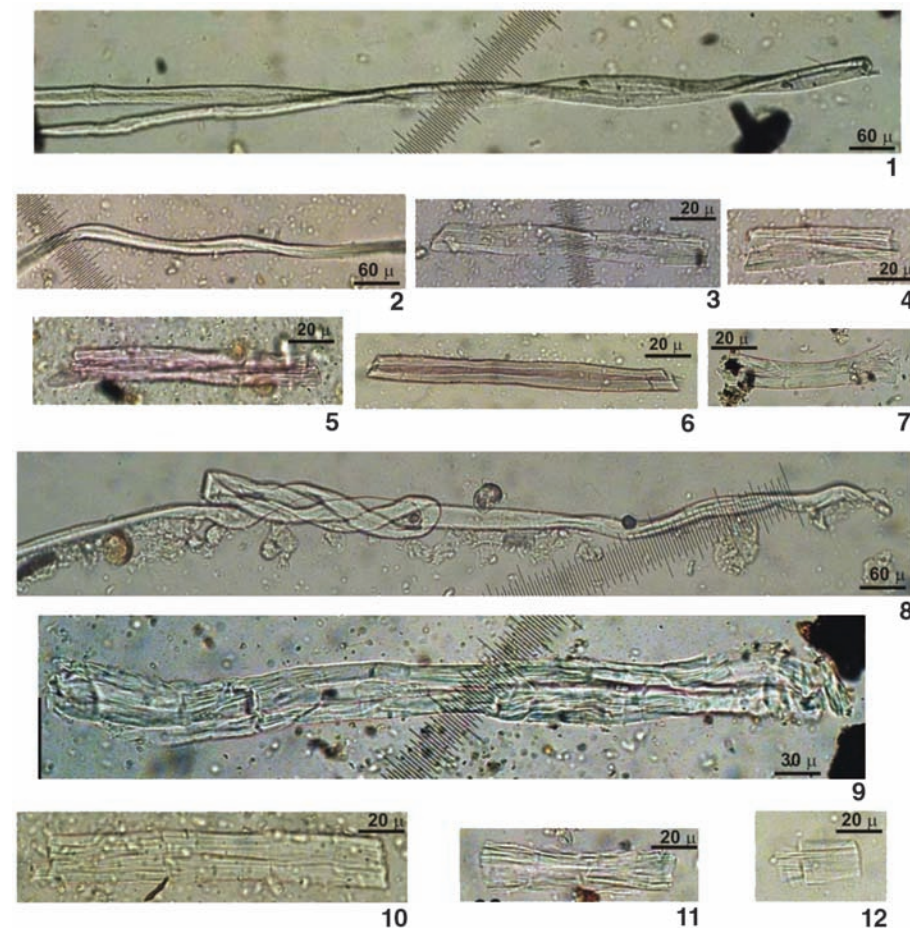
References

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**Fig. 1.** (1 to 7) Fibers from Dzudzuana, Georgia, unit D. 1, twisted flax fibers; 2 to 4, flax fibers; and 5 to 7, unraveled flax fibers. (8 to 12) Fibers from Dzudzuana, unit C. 8 and 9, twisted flax fibers; 10 and 12, flax fibers; and 11, dyed flax fibers.

baskets, or sewing garments. Other reports of the early use of plant fibers include Dolni Vestonice (Czech Republic) at ~29 to 32 thousand years ago (ka) (probably nettle, *Urtica* sp.) (3) and unidentified species in Ohalo II (Israel) at ~21 ka (4).

Radiocarbon dates demonstrate that Dzudzuana Cave was inhabited in the Upper Paleolithic period, during 32 to 26 <sup>14</sup>C years before the present (yr B.P.) [36 to 31 thousand years ago (ka); unit D], 23 to 19 <sup>14</sup>C yr B.P. (28 to 24 ka; unit C), and 13 to 11 <sup>14</sup>C yr B.P. (15.5 to 13 ka; unit B), capped by Late Neolithic/Enolithic deposits of unit A (6.3 to 5 <sup>14</sup>C yr B.P.; 7 to 6 ka) (1) (table S1).

nomorphs, including microfossils of fungi, algae, cormophytes, and animal hair. The flax fibers were present throughout the sequence with a peak in the early stages of unit C. Although climatic fluctuations are recorded through the depositional sequence, flax plants could likely have survived in the immediate environment of the cave during its habitation.

A few of the fibers are colored and appear to have been dyed. A wide range of natural pigments was available to the Upper Paleolithic occupants of the cave, including roots and other plant parts (5). The color range includes yellow, red, blue, violet, black, brown, green, and khaki.