

# THE EARTH-EATERS

Research suggests that consuming soil may have more health implications than one might expect. **Trevor Stokes** sieves through the reasons why people include dirt in their diet.

**A**t Calabash, a West African speciality grocery store in Newark, New Jersey, plastic containers line the impulse-purchase aisle next to the cash register. Hungry shoppers can choose from a wide range of traditional edible offerings, including sacks of caffeine-rich kola nuts, packets of vanilla sugar — and thumb-sized rolls of chalky clay.

In such markets, edible clay isn't a strange thing to find. Joyce Corleley, a Ghanaian customer in the store, says she ate fire-cured clay, known as *shra*, during two of her pregnancies. The dirt became a food substitute that gave her the illusion of eating, without the fear of vomiting food during morning sickness.

Corleley says she doesn't eat clay for medical reasons. "It doesn't give you energy, it doesn't make the baby grow faster, it doesn't make the baby healthy," she says. "It doesn't have any benefit, it's just clay." Several recent scientific studies bear her out — but others suggest otherwise.

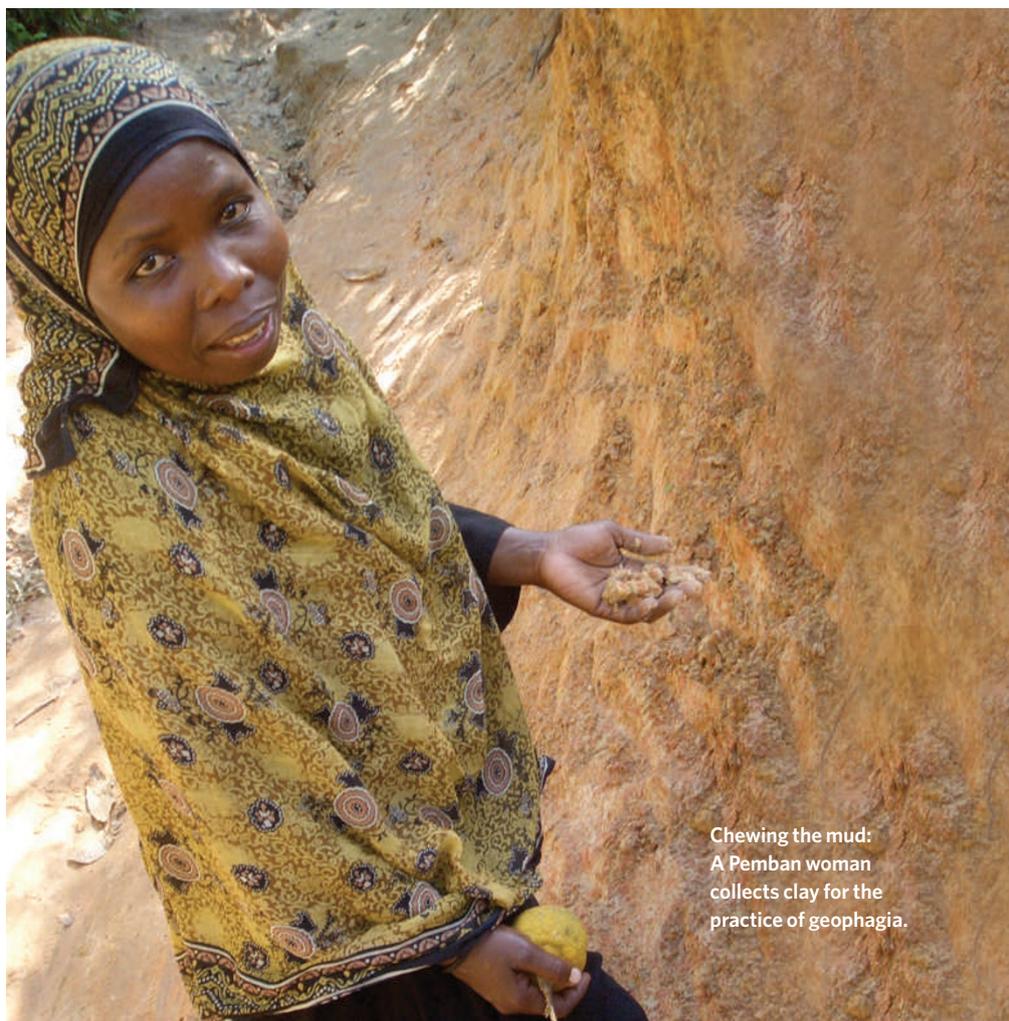
Anthropologists and biologists have long tried to explain geophagia, a practice named after the Greek words for earth-eater. Some researchers say that eating clay helps supplement a person's diet with much-needed minerals. Others argue that the stomach's acidity would remove any of the nutritional benefits. Still others have been searching for any potential evolutionary advantage to the practice, which falls under the general term of *pica* — the consumption of non-nutritive substances ranging from paper to cigarette butts.

## Dirty past

Despite these recent studies, geophagia has received relatively little attention from the research community. "It's one of those topics that, paradoxically, everyone sees as being important, but nobody actually has it as their specialized area of research," says Jeya Henry, a human nutritionist at Oxford Brookes University, UK, and one of the editors of the forthcoming overview book *Consuming the Inedible*<sup>1</sup>.

Records of geophagia exist in all corners of the world, stretching back to 1800 BC in Sumeria, Egypt and China, according to Rudolph Reinbacher, a historian in California<sup>2</sup>. For instance, at least 2,000 years ago, he says, Greek markets sold *terra sigillata*, clay specially minted into "health" coins that had supposed medicinal properties. "People must have felt there was something to it," he says, "so they ate it."

What that 'something' is remains in dispute.



Chewing the mud: A Peman woman collects clay for the practice of geophagia.

According to one leading theory, the dirt serves as a sort of multivitamin. Clay, after all, consists of a lattice of silicon dioxide and aluminium oxide — similar to pill filler — mixed with trace minerals such as calcium, iron and zinc.

In the 1990s, nutrition researcher Susanne Aufreiter of the University of Toronto, Canada, decided to test this 'nutrition hypothesis'. Her team analysed clays that people had eaten during the latter part of the twentieth century in various parts of the world: in China, eaten during famines; in North Carolina, eaten for general health; and in Zimbabwe, eaten to treat diarrhoea. Each of the clays contains levels of trace minerals that could supplement a poor diet, Aufreiter says<sup>3</sup>.

Earth eating might also provide other ben-

efits, she adds. Vegetables wouldn't have been scrubbed the way they are today, and Aufreiter argues that residual earth would have added roughage to the diet. "We didn't evolve with this wonderful hygienic life that we have."

But chemical analyses on clay can miss the nuances of the digestive system through which clay moves. Digested clay may not only hold on to trace elements, but may actually leach them from intestinal tracts, other work suggests.

At Kingston University in Surrey, UK, a team led by soil scientist Peter Hooda created a slurry of clay and simulated gastric acids and nutrient solution, and incubated it at body temperature to simulate conditions in the stomach. The team found that nutrients can become tightly bound to the lattice structure of clay particles, resulting



**Food supplements:** a variety of samples of earth that are consumed in Zanzibar.

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in lower levels of iron, zinc and copper in the slurry<sup>4</sup>. And the higher the acidity, the more tightly the metals became bound to the clay — bad news for the nutritional hypothesis.

Eating soils rich in iron and zinc, it seems, may actually worsen malnutrition, other research suggests. At Cornell University in Ithaca, New York, nutritionist Sera Young has been trying to unravel whether geophagia or malnutrition comes first. Working on the African island of Pemba, off mainland Tanzania near Zanzibar, Young has been studying pregnant women's perceptions of iron-deficiency anaemia.

During her field-work in 2001, Young asked women in Swahili what caused anaemia. One Pamban woman responded that eating dirt from the walls of her home caused anaemia. Young thought she had misunderstood the answer, as Swahili was new to her; but no, the woman pointed and confirmed that her dirt walls caused anaemia. Other Pambans claimed the opposite — that eating earth during pregnancy actually treated their anaemia, rather than caused it.

Intrigued, Young began searching for other cases. Certain that a search of PubMed, the medical journal archive, would clear up the underlying cause of geophagia, she says: "It just was not that simple." One of the biggest difficulties is that geophagia embraces several facets of science. "You need to dabble in soil science, you can't shy away from ethnography, you have to have some epidemiological skills and some biochemical knowledge," she says. "And that's a tall order."

Young and her PhD adviser, nutritional scientist Rebecca Stoltzfus, hope to meet the challenge. In an unpublished epidemiological study of 2,500 Pambans, women who told the researchers that they ate clay had significantly lower levels of haemoglobin, and thus were anaemic. It's not clear yet, though, whether geophagia caused the anaemia, anaemia caused the geophagia, or if a third factor is causing both of them. To test this last option, Young plans to look at the elemental and mineralogical profiles of the clays, to see if there are other bioavailable minerals that could be affecting the women.

Some hints may come from work performed as far back as the late 1950s, which suggested that zinc deficiency may cause geophagia. Ananda Prasad, now a professor at Wayne State University in Detroit, Michigan, encountered several young Iranian men who suffered from stunted growth and slower sexual development. One 20-year-old man physically resembled an eight-year-old boy. All the patients ate clay every day. But when given zinc, they matured sexually and lost their desire to eat clay<sup>5</sup>.

Decades of subsequent work by Prasad and his colleagues showed that a lack of zinc leads to hypogeusia, a taste-diminishing disorder. Prasad reasons that hypogeusia makes dirt if not enjoyable, at least not unattractive, which reinforces the geophagia, leaches more zinc and starts the cycle all over again. And he also doesn't agree with the nutrition hypothesis: "Soils contain nutrients, that's true, that's how we get our nutrients from plants," he says. "But plants absorbing nutrients from soil is different from humans absorbing nutrients from soil."

**"Plants absorbing nutrients from soil is different from humans absorbing nutrients from soil." — Ananda Prasad**

### Ground rules

In perhaps the only randomized, controlled study to see whether anaemia causes geophagia or vice versa, Mbiko Nchito from the University of Zambia and her colleagues have found that supplementing the diet of geophagic, anaemic children with iron did not stop them eating earth<sup>6</sup>. The geophagic children were also more often infected with hookworm, which causes anaemia; but that alone could not explain all the geophagic cases, as several non-infected anaemic children also ate clay.

Similarly, Young's work among Pamban women shows that the clays they eat contain no detectable levels of hookworm. So the simple explanation that hookworm-riddled clay causes nutrient deficiencies doesn't seem to pan out.

The question remains: what possible evolutionary benefits could arise from eating clay? To

address this question, Young has joined forces with Paul Sherman, a social behaviourist at Cornell University in Ithaca, New York, and Julius Lucks, a biophysics graduate student at Harvard University in Cambridge, Massachusetts. They scour popular and scientific literature for first-hand accounts of pica, in order to build up a comprehensive database of the circumstances under which it occurs. To date, they have 1,738 such accounts.

Sherman had previously studied morning sickness as a potential evolutionary adaptation, and looks at geophagia the same way. Clay could serve to help detoxify the body during pregnancy, he argues, by binding to plant toxins such as solanin in raw potatoes or nicotine in tobacco. Morning sickness is most prevalent during the first trimester of pregnancy, which is also when geophagia most commonly shows up. "So putting two and two together," he says, "perhaps there is some advantage in terms of detoxifying plants with strong secondary compounds to protect the fetus against carcinogens and mutagens." Losing nutrients to clay, Sherman argues, is probably negligible in terms of nutrition compared to the cost of throwing up the same toxins.

So far, the group's preliminary results support the idea that those most susceptible to toxins — young children and women in the early stages of pregnancy — most commonly practise geophagia. And, consistent with clay's possible detoxification role, researchers have observed that both men and women eat dirt to treat 'gastrointestinal stress', presumably cases of food poisoning. Over-the-counter stomach remedies, such as Kaopectate and Maalox, contain clay-like ingredients that settle the stomach. According to Sherman's findings, dirt-eaters self-medicate with every chunk of clay they chew.

Back at the Calabash grocery store, Joyce Corlethey picks a tiny corner of clay off a roll and gnaws it matter-of-factly. "You just put it in your mouth so that you have something in there," she explains. But once she was no longer pregnant, her experiment with clay ended. ■

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