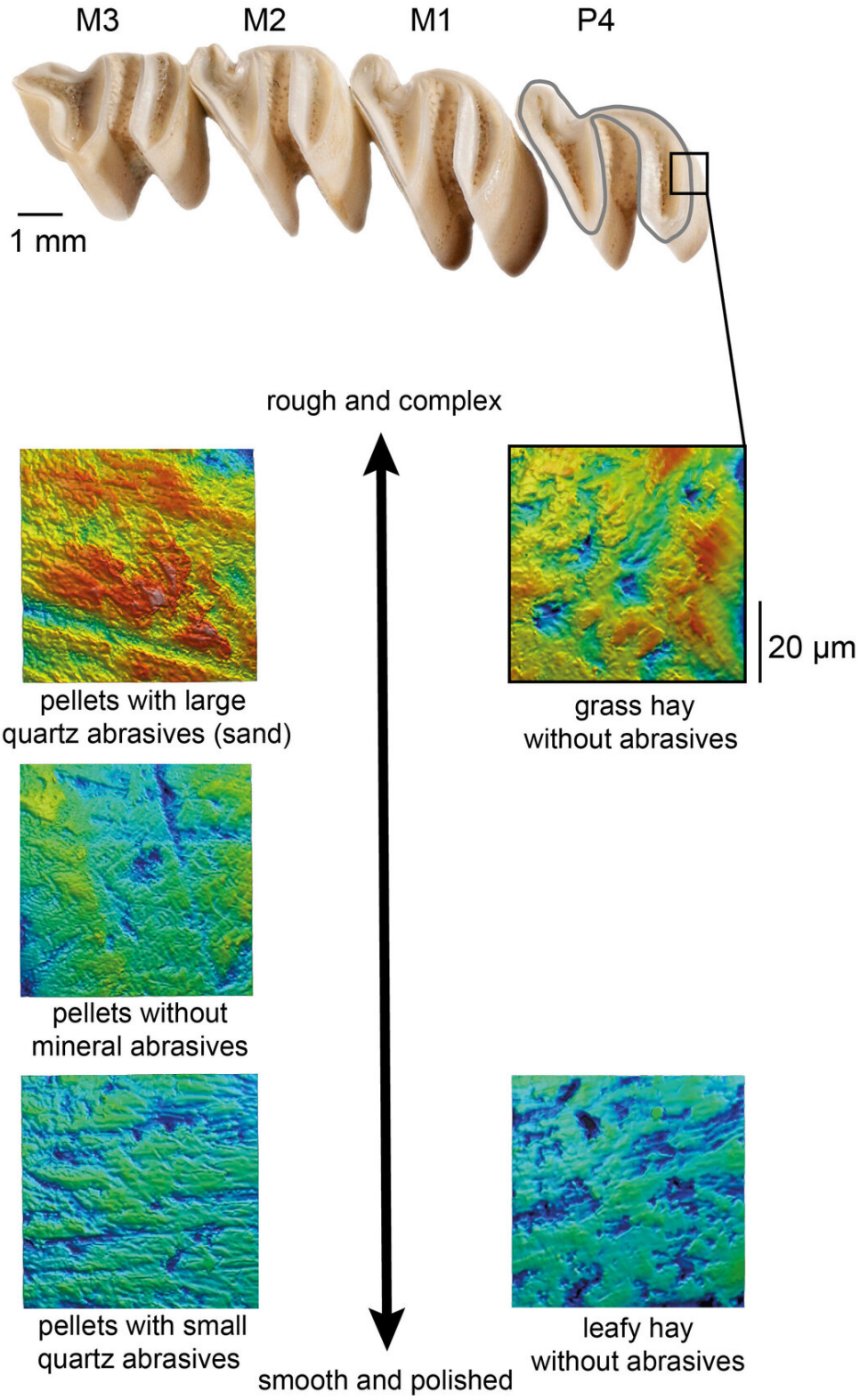
# Mineral dust ingested with food leaves characteristic wear on herbivore teeth

August 25 2020


M3
M2
M1
P4
1 mm
rough and complex
pellets with large quartz abrasives (sand)
grass hay without abrasives
20 µm
pellets without mineral abrasives
pellets with small quartz abrasives
leafy hay without abrasives
smooth and polished

Microscopic images of surfaces of guinea pig teeth show the typical abrasions caused by different foods. Credit: Daniela E. Winkler

Mineral dust ingested with food causes distinct signs of wear on the teeth of plant-eating vertebrates, which can differ considerably depending on the type of dust. This is what paleontologists at Johannes Gutenberg University Mainz (JGU) have discovered in a controlled feeding study of guinea pigs. As they report in the current issue of *Proceedings of the National Academy of Sciences* of the United States of America (*PNAS*), their findings could lead to a more accurate reconstruction of the eating habits of extinct animals as well as a reconstruction of their habitats.

"Analyzing fossil teeth is a common method of drawing conclusions about the diet and habitat of certain animals, because it has long been understood that eating different plants, such as grass or leaves, can cause different wear patterns," said Dr. Daniela Winkler of the Institute of Geosciences at JGU, the first author of the study. "However, there has been hardly any research into the extent to which the consumption of mineral dust contributes to this abrasion."

Over several weeks, the researchers fed 12 groups of guinea pigs with essentially the same plant-based pellets which contained different types and amounts (zero to eight percent) of natural mineral dust. The researchers then used a high-resolution microscope to examine the surface of the tooth enamel of each animal's molars. "We were able to identify some significant differences," added Winkler. For example, larger quartz particles (sand grains) caused severe abrasion on the enamel surface. The same applied to volcanic ash, which, due to its sharp edges, also produced a more irregular wear pattern.

Small quartz particles generated a smooth, almost polished surface. On the other hand, there were no subsequent distinctive signs of wear features in the case of other particles. "Our results should improve the accuracy of diet reconstruction on the basis of fossil teeth," concluded Winkler. To date, it has been assumed that smooth tooth surfaces are related to the respective animal feeding on leaves that, unlike grass, leave hardly any traces of wear on the tooth surface; hence, this animal would have lived in a forest environment.

However, it now seems possible that smooth tooth enamel wear patterns could have also developed because the animal ate grass, for example, to which tiny quartz grains were attached. These particles would have eliminated any irregularities on teeth, leaving an even, polished surface. "It is normal that animals ingest mineral dust along with their food," said Winkler. This is even more likely to be the case the drier the habitat is and the closer the food is ingested to the ground.

**More information:** Daniela E. Winkler et al. Shape, size, and quantity of ingested external abrasives influence dental microwear texture formation in guinea pigs, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.2008149117

Provided by Universitaet Mainz