# Geophagy-a possible soil-based solution for reducing enteric methane emissions?

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Methane (CH4) emissions from ruminant animals and their waste are major global contributors to climate change. In New Zealand they represent 38% of our total greenhouse gas emissions. No viable technologies are yet available for reducing enteric emissions, so we took a novel soil-based approach to this problem, based on the consumption of clay or soil materials (geophagy).
As clays can bind to microbial cells in soils, it seems likely that this mechanism would also operate with respect to methanogens (i.e., microorganisms that produce CH4) in the rumen. We tested this hypothesis using a series of in vitro anaerobic incubation studies by adding clay to artificial saliva (McDougalls buffer) containing minced Lucerne and an inoculum of freshly sampled cow rumen contents. Sixteen clays or clay materials were tested, and their effect on total gas and CH4 production was monitored over 7 hours.
One clay (a hydrothermally altered kaolinite) substantially reduced CH4 production (up to 65%) when the initial rumen pH was in the range 6.0-6.2 (close to the final pH recorded at the end of each experiment). This observation and the results of further experiments (e.g., doubling the clay amount, use of condensed tannin) suggest a predominantly biological mechanism is responsible for the large reduction in CH4 production. Involvement of a microbially-derived inhibitory bacteriocin (small peptide produced by rumen bacteria) seems most likely, as they are also most effective at acid pH's. The kaolinite sample could enhance or prolong this inhibitory effect by forming a surface complex with the bacteriocin through non-electrostatic interactions, including hydrogen bonding, van der Waals interactions, hydrophobic forces and entropy effects. Our results indicate that clays have the potential to influence metabolic processes in animals, including methanogenesis, but it remains to be seen whether our animal-friendly approach could eventually lead to an effective CH4 mitigation strategy