sensitivities of the diverse materials that constitute soil organic matter, which vary in structure, biochemical composition and susceptibility to attack from the enzyme arsenals of soil organisms, as well as environmental conditions such as flooding or drought, which can obscure intrinsic temperature sensitivities[3]. Although it has long been recognized that constituent compounds such as carbohydrates, cellulose and lignin have different decay rates[4], methodological constraints have, until recently, prevented us from determining the temperature sensitivity of these compounds. New insights into the process of decomposition and humification have arisen from the application of analytical techniques such as nuclear magnetic resonance (NMR) spectroscopy to the study of soil organic matter.

Feng and colleagues[1] used heated cables to raise soil temperatures by 3.5–6 °C in a mixed forest in southern Ontario, Canada. Using ^{13}C NMR spectroscopy, they compared soil organic matter in a warmed plot with a non-warmed plot after 14 months. Surprisingly, lignin concentrations decreased in the warmed plot relative to the control plot, indicating that lignin-derived soil organic matter is susceptible to enhanced degradation under warmer temperatures. In contrast, concentrations of the leaf cuticle-derived compound cutin significantly increased in the warmed plot. Together, these findings suggest that the critical factor controlling sequestration of soil organic carbon under warming may be the cutin, rather than lignin, content of plant litter.

Caution is needed in the interpretation of these results, which are derived from non-replicated plots in a single forest, and need to be tested in replicated experiments in other systems. Nevertheless, recent evidence does suggest that the decay of lignin-derived compounds is more rapid and more sensitive to temperature change than previously thought[5,6]. Other studies have shown that alkyl carbon compounds such as cutin and suberin (the root equivalent) are more recalcitrant and of greater importance in humification than previously acknowledged[6]. This is not so surprising, however, given the protective role of cutin and suberin, which make up the waxy surfaces that shield leaves and roots from air, water and microbial degradation[5].

Furthermore, the discovery that warming enhances lignin degradation is yet another nail in the coffin of the long-held belief that the lignin concentration of leaf litter determines its decay rate. This belief stems from a strong negative relationship between the rate of litter decay and the initial concentration of lignin[7]. However, equating the recalcitrant residue remaining after decomposition with lignin content is only valid for wood; most tissue residues contain many other compounds, including cutin[6]. We must therefore revisit the hypothesis that increasing the lignin content of a tissue will limit decomposition.

The results of Feng and colleagues suggest that increasing the cutin content of leaves will lower the rate and temperature sensitivity of litter decomposition. It may therefore be a good idea to explore which plant species, growth forms and functional traits are associated with high cutin contents; this could help modellers to predict the impact of future vegetation movements associated with climate change on organic matter decomposition[8]. The findings might also stimulate investigations into the genetic modification of plants to increase their leaf cutin content. However, the attractiveness of this possibility should be weighed against evidence that differences in litter chemistry within a plant species (as opposed to differences among species) have small effects on decomposition rate. Such changes will not make the material stable, but will only delay the inevitable transformation of elements into their next form.

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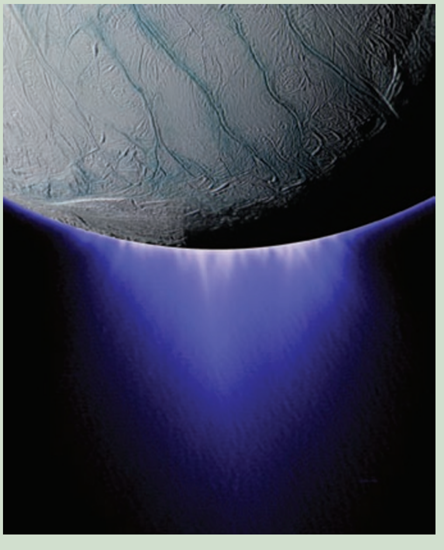
PLANETARY SCIENCE

Jets of mystery

Enceladus, one of Saturn's moons, was placed firmly on planetary scientists' research agenda after the intriguing insights of the Cassini spacecraft in 2005. The diameter of this little moon is 505 km — no larger than the distance between Madrid and Barcelona or Houston and New Orleans — but Enceladus beats most of the other Saturnian moons in terms of activity: plumes of water vapour that have been compared to the Old Faithful geyser at Yellowstone are expelled from four 'tiger-stripes'; long trenches that cross the moon's south pole.

One attractive explanation for the variability of these water vapour eruptions links them to the variation in magnitude of tidal stresses at the moon's surface as it travels along its eccentric orbit. According to this idea, the tiger stripes open under the tension experienced in some parts of the orbit and close when compressed elsewhere, thus regulating the expulsion of water.



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But Enceladean cryovolcanism is not so straightforward, report Candice Hansen, of the Jet Propulsion Laboratory, and colleagues (*Nature* **456,** 477–479, 2008). The researchers took advantage of the occultation of a star by the water plume on 24 October 2007 to estimate the density of the jets, thereby providing a measurement subsequent to the 2005 Cassini fly-by. Contrary to the tidal stress model, which predicted a weaker plume, the water column density in the 2007 plume was about twice as large as that observed in 2005.

Although the mechanism proposed originally does not therefore appear to hold, it may just need refining: not only does the magnitude of the tidal stresses vary throughout Enceladus' eccentric orbit, but the longitude of the tidal bulge also oscillates. A more sophisticated model that accounts for this additional effect may better explain when, and how vigorously, Enceladus expels its water jets.

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