Sediments and incision

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Geology **36,** 535–538 (2008)

Landscapes respond to tectonic uplift through the incision of bedrock by rivers. However the controls on incision are not fully understood. A recent study finds that the sediments suspended in the rivers may play a key role.

Patience Cowie from the University of Edinburgh, UK and colleagues studied the longitudinal profiles — the variations in gradients of river channels — of four Mediterranean rivers flowing across active faults, as well as the nature and supply rates of the river sediments. They found that flow of water alone is insufficient to account for the observed incision rates in response to fault uplift. The researchers suggest that the characteristics of sediments and different supply rates exert a primary influence.

Thus sediment characteristics can complicate inferences on recent or ongoing uplift derived from longitudinal river profiles.

Lost forests

Science **320,** 1622–1625 (2008)

Greenland was forested — and relatively ice free — as recently as 400,000 years ago, according to new research. Today, Greenland's limited vegetation primarily consists of shrubs and herbs.

Anne de Vernal and Claude Hillaire-Marcel of the Université du Québec à Montréal analysed the pollen grains preserved in marine sediment cores from the North Atlantic Ocean over the past one million years. Although all interglacial periods showed some increase in pollen, and thus vegetation in source areas, sediments from the interglacial period 400,000 years ago revealed an unprecedented expansion of trees and other forest plants. The team suggests that during this unusually long interglacial, spruce forests rapidly colonized much of the terrain in Greenland that had been exposed by glacial retreat.

The researchers conclude that, relative to today, ice sheets on Greenland were greatly reduced 400,000 years ago. They suggest that melting of the Greenland ice sheet contributed significantly to the high sea levels recorded during that period.

Carbon on Titan

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Carbon monoxide is abundant in Titan's atmosphere but its origins are still debated. According to a recent study, a stream of oxygen ions from space could generate the observed carbon monoxide levels.

Sarah Hörst from the University of Arizona and colleagues numerically simulated light-induced reactions of various chemical components found in Titan's atmosphere. Their calculations incorporated the steady supply of positively charged oxygen ions, possibly derived from Saturn's moon Enceladus, which was recently reported by the Cassini mission. The team found that a reaction between the exotic oxygen ions and the abundant methane that is found in Titan's atmosphere could explain the presence of much, if not all, of the carbon monoxide that had been detected at Titan.

Therefore neither a high primordial abundance of carbon monoxide nor a continued release of this carbon species from the planet's interior are needed to explain the chemical composition of its atmosphere.

Methane melting

ISTOCKPHOTO.COM / ROB BROEK

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Melting ice sheets may release significant quantities of the greenhouse gas methane. Methane-producing microorganisms thrive in the bases of glaciers and ice sheets, but until now their overall contribution to the global methane budget has been unknown.

Jemma Wadham, of the Bristol Glaciology Centre in the UK and colleagues used estimates of organic carbon stored under continental ice sheets to simulate the amount of methane produced beneath the European and North American ice sheets during the last glaciation, which ended approximately 10,000 years ago. The team found that 418–610 Pg of organic carbon was trapped beneath these ice sheets, and of this, 63 Pg was available for microbial conversion to methane. They show that this methane only influences climate if it is released episodically in large quantities.

The researchers suggest that methane release from subglacial environments may help to explain past variations in atmospheric methane concentrations.

Too hot for tectonics

Earth Planet. Sci. Lett. **271,** 34–42 (2008)

The Earth's plate tectonics could grind to a halt under prolonged high atmospheric temperatures (much greater than those associated with anthropogenic climate change), according to new research. Active plate motion distinguishes the Earth from other planets in the Solar System.

Adrian Lenardic from Rice University, Texas and colleagues used a scaling analysis to assess the implications of a sustained increase in surface temperatures on the convective style of terrestrial planets. Under surface greenhouse conditions, the mantle warms and becomes less viscous. With a runnier interior, mantle convection cannot impart the stress required to break the solid lithosphere — the key to sustaining plate tectonics.

The team's numerical simulations show that a temperature increase of 100 °C or greater lasting for at least one hundred million years is needed for a complete shutdown.