Melt beneath

Tectonophysics doi: 10.1016/j.tecto.2009.01.013 (2009)

Seismic data reveal that surface waves travelling through the lower and middle crust below the northwestern Himalaya have relatively low velocities. This analysis provides strong support for the presence of partially molten rock in this portion of the Earth's crust.

Warren Caldwell from Stanford University, and colleagues processed and analysed surface-wave data collected from the Himalayan region. Because the progress of surface waves through the crust is impeded by fluids, lower seismic velocities are a useful indicator of the presence of fluids. Their results indicate the presence of a low-velocity layer in the middle to lower crust underlying the Himalaya. The group suggests this layer is about three to seven per cent melt, probably mixed with aqueous fluids.

These data provide support for the much debated hypothesis that the deformation of the Himalaya is accommodated by the flow and extrusion of low-viscosity, partially molten crustal material at depth.

Glacial contribution

Geophys. Res. Lett. **36,** L03501 (2009)

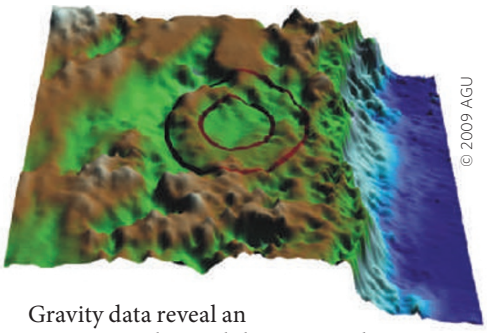
In order to reach equilibrium with today's climate, the melting of small glaciers and ice caps will contribute over 18 cm to sea-level rise. The current volume of most mountain glaciers and ice caps is larger than can be maintained by modern climate regimes.

David Bahr, of Regis University, Colorado, and colleagues assessed the state of glaciers and ice caps worldwide by comparing the area over which ice is actually accumulating, with the area of accumulation needed to maintain the glacier's current volume. The team found that to reach equilibrium with the climate of the period 1997 to 2006, mountain glaciers and small outlet glaciers in Greenland and Antarctica will lose on average 27 per cent of their current volume.

The imbalance between actual accumulation and equilibrium accumulation has been growing since the 1960s. If this trend continues, small glaciers could lose up to 55 per cent of their volume — contributing up to 37 cm of sea-level rise over the next 100 years.

Antarctic impact

Geochem. Geophys. Geosys. **10,** Q02014 (2009)



Gravity data reveal an approximately 500-kilometre-wide impact crater beneath the East Antarctic ice sheet. This Wilkes Land crater is three times larger than the Chicxulub crater associated with the Cretaceous–Tertiary boundary mass extinction.

Ralph von Frese of Ohio State University and colleagues analysed satellite-derived gravity field data for the East Antarctic crust, and found evidence for a vast ring of thin crust similar to impact craters observed on the Moon and other terrestrial planets. The kilometres of ice covering the crater prevent direct dating of the event, but rocks from the Permian–Triassic boundary exposed in the nearby Transantarctic Mountains contain meteorite fragments and an iridium anomaly, which the researchers relate to the impact crater.

Palaeogeographic reconstructions for the Late Permian period place the impact basin at the antipode of the Siberian Traps flood basalt province. The researchers suggest that the energy released from the impact could have triggered the massive eruptions, with both events contributing to the Permian–Triassic mass extinction.

Breathing out bromoform

Glob. Biogeochem. Cycles doi:10.1029/2008GB003338 (2009)

The highly volatile gas bromoform — which is a precursor to ozone degrading bromine radicals — is produced by algae in the upper ocean. Analyses of climatological data now show that chlorophyll concentrations, together with salinity and mixed layer depth, control bromoform release from tropical waters.

Carl Palmer and Chris Reason, of the University of Cape Town, South Africa, used regression analyses to assess the factors controlling bromoform concentrations in tropical surface waters. With the help of climatological datasets, they assigned salinity, mixed layer depth and chlorophyll *a* values to more than two thousand measurements of surface-water bromoform concentrations. Together, these three parameters captured a significant amount of the variability in bromoform levels, which were positively correlated with chlorophyll *a* and mixed layer depth, and negatively correlated with salinity.

Using a model that incorporates these three parameters, the authors are able to accurately reconstruct previous surface-water measurements; they estimate that 1.45 billion moles of bromoform are released from tropical oceans to the lower atmosphere each year, equivalent to 75 per cent of global sea-to-air bromoform emissions.

Down from the mountain

Geology **37,** 243–246 (2009).

Rising springs have repeatedly flooded the otherwise extremely arid Hexi Corridor in northwestern China since 2005. An analysis of the spring-water properties points to glacier melt in the nearby Qilian Mountains as the source of the rising water table.

Jian Sheng Chen from Hohai University, China, and Chi-yuen Wang analysed the chemistry and isotopic composition of water samples collected in the Hexi Corridor and the adjacent mountain slopes. In summer, the water properties were affected by both glacier meltwater and the local atmospheric recirculation of water used in irrigation. But in winter — when the floods occurred — the water characteristics did not indicate an influence of irrigation water.

The researchers conclude that the flooding is best explained by the accelerated glacier retreat of up to 7 m yr^{-1} that has been documented in the Qilian Mountains since the 1980s. Discharge of the water may have been facilitated by a magnitude 6.1 earthquake that occurred in the Hexi Corridor in 2003.