Wearing Yucca down

Geomorphology
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US DEPARTMENT OF ENERGY

The Yucca Mountain region of Nevada has been proposed as a site for long-term burial of US nuclear waste. Understanding potential natural hazards in the area is therefore crucial. Recent modelling shows that erosion may bevel the crest of the mountain range to the elevation of the proposed repository, in as little as half a million years.

Along with his colleagues, Kurt Stüwe of the University of Graz, Austria used simple numerical modelling to explore erosion rates at the crest of Yucca Mountain. The group's most conservative estimates, which incorporate the local geology of the mountain range, indicate that the repository could be exposed within 5 million years. Other factors, such as renewed uplift, may reduce this time.

Previous work on natural hazards in this region has focused on tectonic deformation and volcanism. The researchers conclude that erosion processes also have the potential to affect the long-term stability of this repository.

Missing Miocene carbon

Paleoceanography
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Carbon isotopes indicate that during the Miocene period (17.5 to 13.5 million years ago), more organic carbon was buried than at present. Observations from sites scattered throughout the Atlantic Ocean now rule out the ocean floor as the primary storage site.

Liselotte Diester-Haass, of the Universitaet des Saarlandes, Germany, and colleagues measured numerous proxies for past oceanic productivity from three marine sediment cores. They found evidence for occasional increases in local productivity throughout the Miocene period, but no indications of a widespread spike in marine surface productivity associated with the prolonged carbon isotope excursion. Instead, results from a numerical box model indicate that the excursion could have been driven by rising deposition of organic carbon in peat and wetlands.

Despite the burial of so much organic carbon, most proxy records indicate little to no accompanying decline in atmospheric carbon dioxide concentrations. The group found that emissions from flood volcanism during the Miocene period could not fully balance the carbon sequestration, opening a new search for the missing carbon source.

Scavenging the metals

Science **323,** 764–767 (2009)

The formation of ore deposits has traditionally been associated with fluids that contain common amounts of dissolved metals that precipitate under unique conditions. New data indicate that the concentrations of metals in the hot fluids responsible for ore genesis may have been unusually high instead.

Jamie Wilkinson, of Imperial College, London, and colleagues collected samples from two different ore deposits and measured the lead concentrations of tiny fluid inclusions trapped in zinc sulphide — an ore mineral — and in associated quartz. Such a direct analysis of inclusions in ore minerals was previously hindered by technical challenges. The researchers found that the inclusions from zinc sulphide contained far more lead than those in quartz. They suggest that the lack of data on inclusions from ore minerals may have led to an underestimation of the metal concentrations of ore-forming fluids.

These findings imply that ore deposits may result from the episodic introduction of solutions that are exceptionally enriched in metals and that are derived, perhaps, from distinct source regions.

Dating tsunamis

J. Geophys. Res. **114,** B01319 (2009)

The northeastern coast of Japan has been inundated by 17 tsunamis during the past 6,000 years, some of which were much larger than those described in the historical record. New ages obtained from tsunami deposits show that they were irregular events, with recurrence intervals ranging from one to several hundred years.

The prehistoric tsunamis left behind extensive layers of sand as they receded. Yuki Sawai, of the Geological Survey of Japan, and colleagues studied these sequences at two locations in eastern Hokkaido. The team used radiocarbon measurements to date organic-rich layers above and below each sand sheet, constraining the timing of each tsunami. Their techniques yielded a higher degree of precision than previous work, which used the ages of interbedded volcanic material instead.

The new ages show a more variable event frequency than previously inferred.

Arctic haze

Geophys. Res. Lett. **36,** L02813 (2009)

During late spring and early summer, a thick haze tends to develop over the Arctic region. Recently released observations from the spring of 2008 show that aerosols generated by biomass burning across Siberia and Kazakhstan were the dominant component of the hazy plumes.

Carsten Warneke, of the US National Oceanic and Atmospheric Administration, and colleagues conducted a series of airborne observations over northern Alaska in April 2008, using an aircraft designed to measure a range of aerosol components. During their trips they encountered 50 thick aerosol plumes, ranging in height from the Earth's surface up to 6.5 km in altitude. They found high concentrations of the chemicals acetonitrile and benzene in the plumes, which are indicative of a biomass-burning origin. An atmospheric transport model, used to pinpoint the location of the source, shows that the plumes were generated by forest fires in Southern Siberia and agricultural burning in Northern Kazakhstan.

The researchers conclude that an earlier than usual start to the fire season in Siberia and Kazakhstan may have resulted in the unusually efficient transport of smoke and aerosols to northern Alaska.