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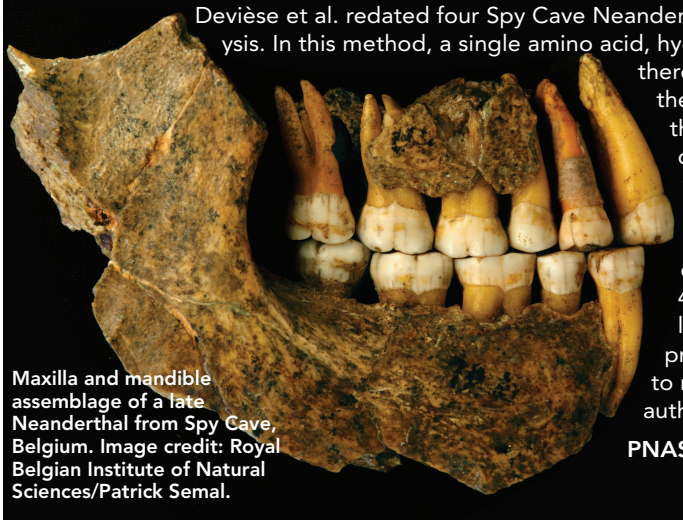
March 23, 2021

ANTHROPOLOGY

Neanderthal disappearance from Northwest Europe

The timing of Neanderthal disappearance remains uncertain. Radiocarbon dating of Neanderthal remains from Spy Cave in Belgium has yielded ages as recent as approximately 24,000 years ago, placing the finds among the latest surviving Neanderthals in Europe. However, the reliability of these dates is uncertain due to possible sample contamination. Thibaut Devièse et al. redated four Spy Cave Neanderthal specimens using compound-specific radiocarbon analysis. In this method, a single amino acid, hydroxyproline, was isolated from bone collagen and dated, thereby minimizing risks of unremoved contamination. Most of the dates obtained using this method were much older than those obtained previously—up to 10,000 years in certain cases. The authors also dated Neanderthal specimens from two additional Belgian sites, Fonds-de-Forêt and Engis, and obtained ages comparable to those from Spy Cave. Based on the newly obtained radiocarbon dates, the authors estimate that Neanderthals disappeared from the region 44,200–40,600 years ago, much earlier than previously published dates suggest. The results support the use of robust pretreatment methods when dating Paleolithic human remains to minimize biases due to contamination, according to the authors. — B.D.



Maxilla and mandible assemblage of a late Neanderthal from Spy Cave, Belgium. Image credit: Royal Belgian Institute of Natural Sciences/Patrick Semal.

PNAS e2022466118 (2021)

IMMUNOLOGY AND INFLAMMATION

How JNK signaling influences biliary cyst formation in aging mice

Signaling pathways involving stress-activated c-Jun N-terminal kinases (JNKs) play a crucial role in cell death, cell proliferation, and malignancies in the liver. So far, the role of JNK signaling in mouse liver disease models has been studied using young mice, whereas many liver diseases in humans typically manifest in the elderly. To examine the potential roles of JNK signaling during aging, Katrin Müller, Hanna Honcharova-Biletska, Christiane Koppe, et al. generated JNK1/2$^{LPC\text{-}KO}$ mice with combined conditional ablation of *Jnk1* and *Jnk2* in liver parenchymal cells (LPCs). Aging JNK1/2$^{LPC\text{-}KO}$ mice spontaneously formed large biliary cysts that developed from the biliary cell compartment, and young JNK1/2$^{LPC\text{-}KO}$ mice were found to have liver injury associated with spontaneous apoptosis and necrosis of LPCs. The researchers found that liver cyst formation in these mice was dependent on receptor-interacting protein kinase 1 (RIPK1), a key regulator of survival, apoptosis, and necroptosis. The authors also found that RIPK1 was overexpressed in a subset of patients with polycystic disease, suggesting that it may play a role in the pathogenesis of hepatic cyst formation in humans. According to the authors, JNK signaling and the cell-death mediator RIPK1 interact to maintain liver homeostasis during aging, and understanding these interactions could help develop new therapies for polycystic liver diseases. — S.R.

PNAS e2007194118 (2021)

EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

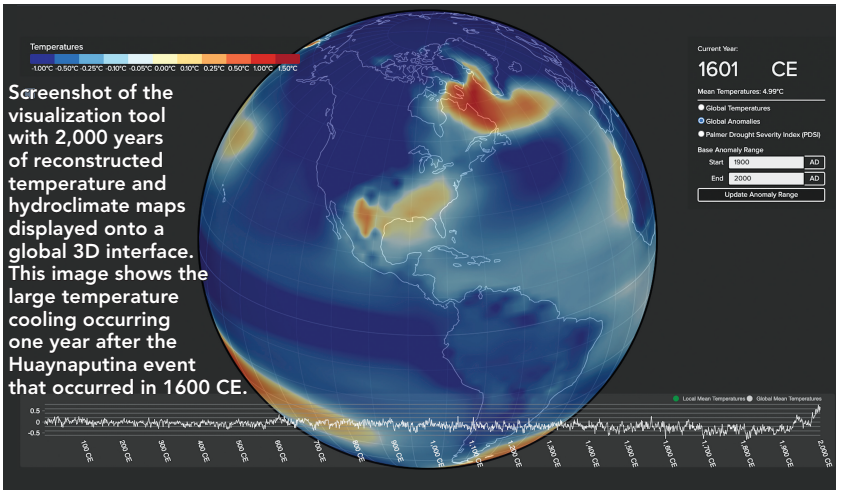
Yangtze flooding and Indian Ocean conditions

Increased summer monsoon rain along the Yangtze River Basin is typically linked to strong El Niño conditions. In 2020, however, deadly flooding followed a weak El Niño winter. Zhen-Qiang Zhou et al. report that warming in the Indian Ocean led to the extreme monsoon rains. To uncover possible predictors of the anomalous rainfall, the authors evaluated sea surface temperature effects using a global atmospheric model and observed monthly data from January 2019 to July 2020. The model predicted the excessive rainfall, with most of the effect attributable to temperature anomalies in the Indian Ocean rather than the Pacific Ocean. Next, the authors examined what may have contributed to the sea surface temperature anomalies, focusing on the 2019 Indian Ocean Dipole event in which the temperatures of the eastern and western areas of the ocean differed more strongly than usual. The authors found that this positive dipole event, combined with the weak El Niño, excited Rossby waves in the Indian Ocean. The slowly propagating planetary waves deepened the thermocline by 70 m, increasing the penetration of warm surface water and contributing to sustained ocean warming. According to the authors, dynamic models incorporating global ocean events could help predict future summer monsoon dynamics. — T.H.D.

PNAS e2022255118 (2021)

ENVIRONMENTAL SCIENCES

Volcanic effects on global climate



Screenshot of the visualization tool with 2,000 years of reconstructed temperature and hydroclimate maps displayed onto a global 3D interface. This image shows the large temperature cooling occurring one year after the Huaynaputina event that occurred in 1600 CE.

Volcanic eruptions can affect Earth's climate, but the hydroclimatic impacts of large tropical eruptions remain incompletely understood. Ernesto Tejedor et al. estimated the global and seasonal hydroclimate impacts of all known tropical volcanic eruptions over the last millennium that were larger than the 1991 Mount Pinatubo eruption. The analysis revealed that large volcanic eruptions were followed by anomalously dry conditions over tropical Africa, Central Asia, and the Middle East, whereas Oceania and the South American monsoon regions experienced wet conditions following eruptions. In some regions, the climate anomalies persisted for a decade or more and were associated with sea surface temperature changes in the Pacific and Atlantic Oceans. The authors compared the proxy-based results with a stand-alone global climate model and found that the climate effects of tropical volcanic eruptions estimated from the proxy-based results were larger and more persistent than those in the stand-alone model. According to the authors, understanding why a discrepancy exists between hydroclimate effects estimated from a proxy-based product and a stand-alone climate model is critical for uncovering how future eruptions may affect the global climate, even as the eruptions superimpose on impacts from anthropogenic climate change. — P.G.

PNAS e2019145118 (2021)

ECOLOGY

Drivers of host and parasite diversity across tropical Andes

Barred parakeet (*Bolborhynchus lineola*) from Cuzco, Peru.

Host–parasite interactions can affect the range limits of species, but the exact effects on community composition are not well understood. Sabrina McNew et al. used flexible nonlinear models to identify the factors underlying diversity patterns—both richness (alpha diversity) and turnover (beta diversity)—in interacting bird and haemosporidian parasite communities of the Peruvian Andes. The authors sampled 18 communities encompassing around 1,350 bird species and around 400 haemosporidian parasite lineages across a range of elevations, climates, primary productivity, and species richness. Precipitation was the strongest predictor of both host and parasite species turnover, with a greater difference in precipitation regimes resulting in fewer bird and haemosporidian species shared between any two localities. Other drivers of turnover were markedly different between host and parasite, with environmental variables, including temperature, net primary productivity, and elevation, largely predicting host turnover. In contrast, host communities shaped parasite diversity patterns but not vice versa. The spatial scales of these processes were complex: The effects of climate on parasite turnover were mainly local, whereas host effects manifested on broader scales. The authors used the models to map host and parasite turnover and richness. Such maps could be used to identify turnover hotspots that could guide host and parasite biodiversity conservation, according to the authors. — S.R.

PNAS e2010714118 (2021)

JOURNAL CLUB

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March 23, 2021

GENETICS

Agricultural spray could quickly deliver advantageous genes to crops mid-growing season

Posted on March 12, 2021

Carolyn Beans

Plant breeders are masters of genome tuning, spending years developing crops with the genes to resist disease, drought, and pests. Now, a team of industry and academic researchers in Germany and the United Kingdom has developed a viral vector technology that could accomplish similar feats temporarily by delivering genes to plant cells via an agricultural spray. The tool, recently described in recently described in *Nature Plants* might one day help growers respond to environmental challenges mid-season by adjusting traits like flowering time or drought tolerance, while avoiding the pitfalls of pesticides—all without altering the crop's genome. Continue Reading➲

A new approach might one day use ordinary crop sprayers like this one to quickly deliver genes designed to respond to environmental challenges such as drought. Image credit: Shutterstock/FotoKostic.

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