Expressing similar exhilaration at the new results, Debra Fischer, professor of astronomy at Yale University, New Haven, Conn., said Kepler-11 "is obviously a staggering result." She said the discovery of the transiting system "is as momentous as 51 Peg was in 1995," referring to the earlier discovery of the first extrasolar planet orbiting a Sun-like star, star 51 in the constellation Pegasus.

"Kepler has blown the lid off of everything we knew about extrasolar planets. This week to me feels very different than last week did," said Fischer, noting that the telescope, which looks for planet signatures by measuring decreases in the brightness of stars caused by transiting planets, is reaching its milestones much faster than she had originally envisioned. "Kepler is reaching out to different parts of the Milky Way galaxy than we've observed with Doppler technology. It shows us that the adjacent neighborhoods in the galaxy look a little like our own neighborhood. That's encouraging and important if we are trying to make extrapolations about the formation of planets and perhaps also life."

Douglas Hudgins, Kepler program scientist with NASA in Washington, D. C., said the Kepler mission "is absolutely revolutionizing our understanding of exoplanetary systems and exoplanets of all sizes." Hudgins added that "the holy grail" of the mission is the discovery of Earth-sized planets orbiting in the habitable zone of a star similar to our own Sun. "The milestones that Kepler achieves with each and every day shape the course of all future exoplanet missions," he noted.

Launched in 2009, Kepler is in a heliocentric orbit surveying an area of space in the Cygnus and Lyra constellations portion of the Milky Way galaxy for extrasolar planets. For more information, visit http://www.nasa.gov/mission_pages/kepler/main/index.html.

—Randy Showstack, Staff Writer

FORUM

Otherworldly Earths: The Future of Deep Time Research

PAGE 55

Once a week, *Eos* brings to the Earth and space science community new views of Earth, and often this message contains reports of a warming Arctic, rising sea level, organisms and ecosystems in flux, changing atmospheric composition, and other processes that are driving us to an increasingly foreign Earth system. However, as geoscientists we know that the Earth today—of the past few thousand years—is only one state of how the Earth works. Within rock, ice, and seafloor, the residua of long-gone (and often very different) times serendipitously linger. The Deep Time Earth-Life Observatory Network (DETELON) initiative, which aims to study these long-gone times, defines deep time as the 99.94% of the Earth's history that preceded the current ice age (which began about 2.6 million years ago) and configured the climate and biota of the Earth before extensive human impacts. Within this time is the vast majority of what the Earth has been and what it can be, including not only novel Earth systems (e.g., tropical forests without flowers) but also analogs for anthropogenic climate change (e.g., rapid atmospheric carbon dioxide (CO_2) rise) and extraterrestrial ecosystems (e.g., a planet inhabited only by microbes).

Recent progress in geochronology, biogeochemistry, and quantitative methods for studying diversity, evolution, ecological interactions, and climate allows us to pose new synthetic questions about the pace and nature of biotic and climatic change. We need new field-based, interdisciplinary investigations of critical episodes in the history of life and the environment through the integration of geochemistry, geochronology, and chemical and dynamical modeling with the realms of paleobiology. Our national and university museums are stocked with arguably the best fossil collections in the world, as are similar facilities that archive cores sampling ocean, lake and land rock, sediment, and ice. We propose initiatives to support a new understanding of these materials and thus of the Earth.

There's reason for new hope that the constrictive funding situation in the Earth sciences is beginning to ease under President Obama's administration. In February 2010 the U.S. National Science Foundation (NSF) requested an 8% budget increase from Congress. In addition, the 2009 American Recovery and Reinvestment Act provided $3 billion in new money to NSF. This is welcome news from an administration that has stated its goal to increase America's investment in research to 3% of the gross domestic product. Within these increases the NSF Geosciences Directorate (GEO) is specifically targeted: GEO/Earth Science will have a $200 million budget in fiscal year (FY) 2011, an increase of 25% over FY 2008 levels. In early February in Washington, D. C., a group of particularly vocal and energized paleobiologists, stratigraphers, geochemists, and others participated in an NSF workshop to shape the DETELON initiative. The goal of the DETELON program is to address compelling, process-related questions about the interactions of environmental and biotic change in deep time. This requires the integration of multiple disciplines to transform our understanding of the dynamics of environmental and biotic change. This approach has been used to great effect in many international contexts; the question is, How should future initiatives in this area be shaped?

As a community, we need to be ready to loudly advocate for the areas that demand new efforts in scientific inquiry. During the 2010 AGU Fall Meeting, members of the DETELON executive committee held a town hall meeting to hear what AGU members think about the ways in which research in this area could be stimulated by cross-disciplinary initiatives. The discussion, "The Future of NSF Funding for Paleobiology Research," considered the possible roles of modeling and modern-analog data sets to complement fossil collections. How many collaborators should be included in a successful grant application to DETELON, and how broadly their expertise should be distributed, was discussed at length.

We welcome your input as we continue to build consensus and initiative on the many ways in which deep time research is a driver for understanding both the ancient and modern Earth and the planets beyond. One driving question is, How should support be structured? In our early conversations the executive committee envisioned each DETELON "observatory" to involve integrated teams of 10–20 paleontologists, geochemists, stratigraphers, geochronologists, paleoclimatologists, modelers, and other geoscientists. Each observatory would last for 5–10 years (an initial 5-year grant followed by a possible renewal). Projects would need to integrate existing data sets, plan coordinated fieldwork and analyses, and develop quantitative, process-based models. DETELON projects will provide significant opportunities for junior faculty and postdoctoral scholars and include joint training of graduate students. We hope that you will provide additional input to help us identify emergent topics for potential support and discuss how this support is best structured; please contact us through the DETELON Web site (http://www.detelon.org) and share your thoughts.

—A. Hope Jahren, Geology and Geophysics, University of Hawai`i at Mānoa, Honolulu; E-mail: jahren@hawaii.edu; David J. Bottjer, Department of Earth Sciences, University of Southern California, Los Angeles; Douglas H. Erwin, Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, D. C.; Dena M. Smith, Museum of Natural History and Department of Geological Sciences, University of Colorado at Boulder; and Richard D. Norris, Scripps Institution of Oceanography, La Jolla, Calif.