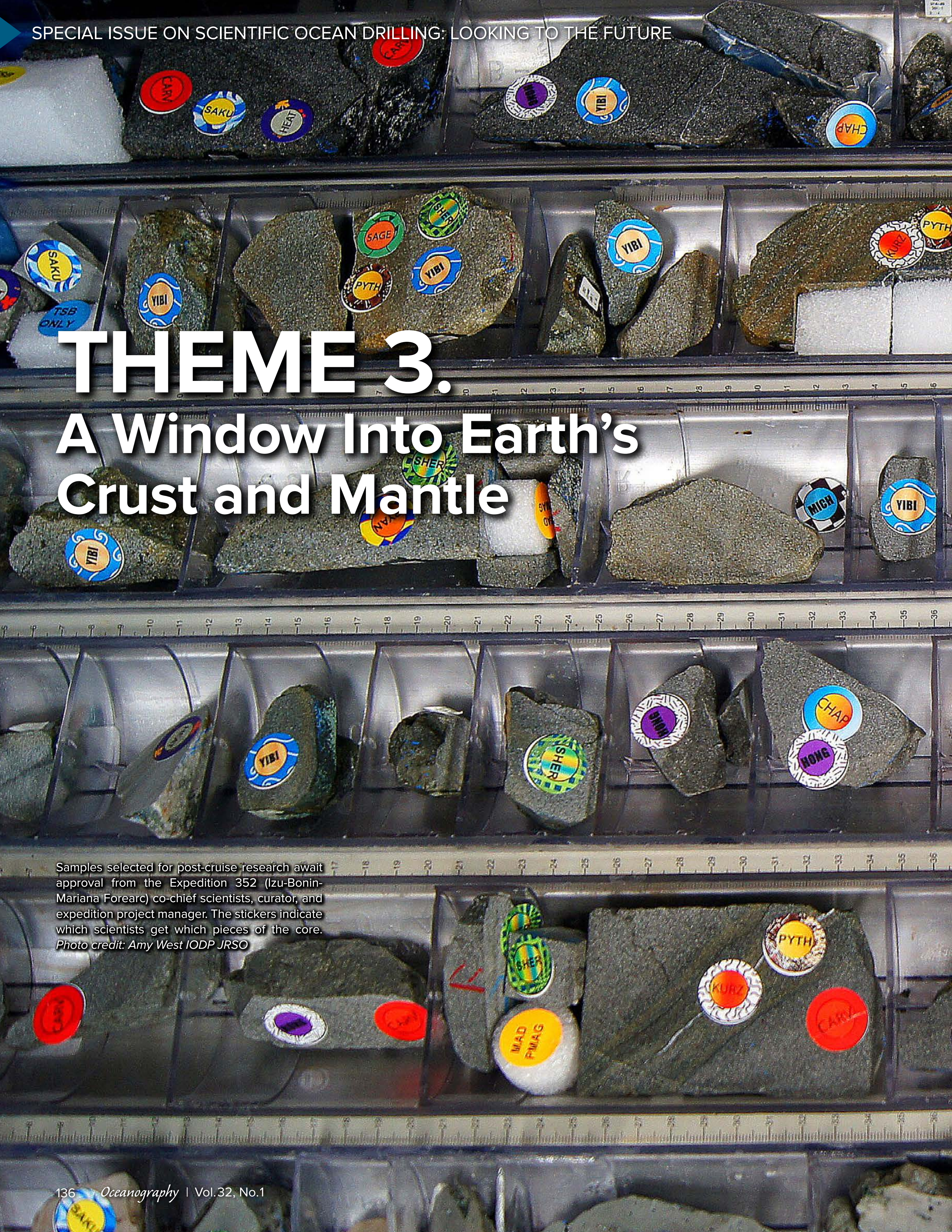
CITATION

Koppers, A.A.P. 2019. Introduction to Theme 3: A window into Earth's crust and mantle. *Oceanography* 32(1):136–137, https://doi.org/10.5670/oceanog.2019.135.

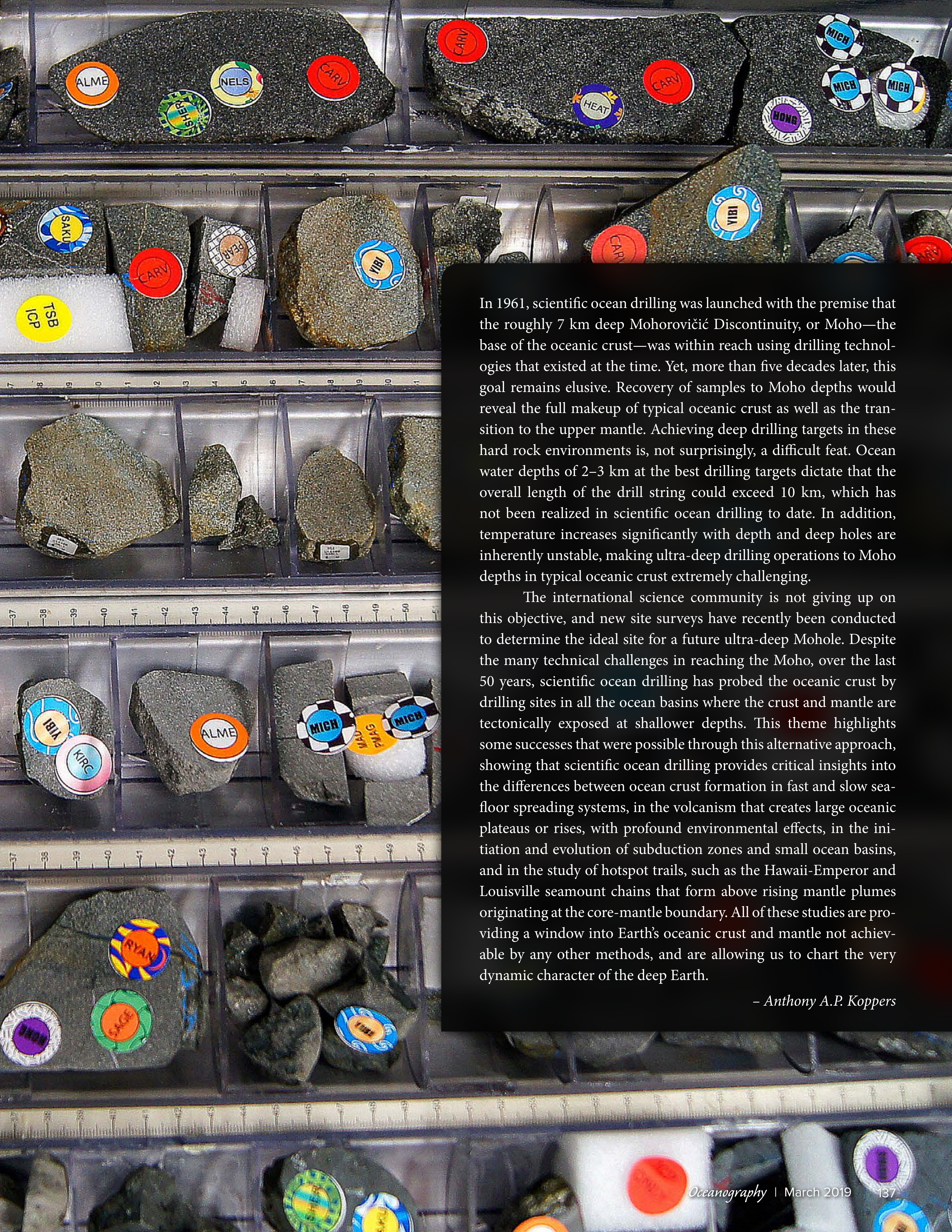
DOI

https://doi.org/10.5670/oceanog.2019.135



THEME 3.
A Window Into Earth's Crust and Mantle

Samples selected for post-cruise research await approval from the Expedition 352 (Izu-Bonin-Mariana Forearc) co-chief scientists, curator, and expedition project manager. The stickers indicate which scientists get which pieces of the core. *Photo credit: Amy West IODP JRSO*



In 1961, scientific ocean drilling was launched with the premise that the roughly 7 km deep Mohorovičić Discontinuity, or Moho—the base of the oceanic crust—was within reach using drilling technologies that existed at the time. Yet, more than five decades later, this goal remains elusive. Recovery of samples to Moho depths would reveal the full makeup of typical oceanic crust as well as the transition to the upper mantle. Achieving deep drilling targets in these hard rock environments is, not surprisingly, a difficult feat. Ocean water depths of 2–3 km at the best drilling targets dictate that the overall length of the drill string could exceed 10 km, which has not been realized in scientific ocean drilling to date. In addition, temperature increases significantly with depth and deep holes are inherently unstable, making ultra-deep drilling operations to Moho depths in typical oceanic crust extremely challenging.

The international science community is not giving up on this objective, and new site surveys have recently been conducted to determine the ideal site for a future ultra-deep Mohole. Despite the many technical challenges in reaching the Moho, over the last 50 years, scientific ocean drilling has probed the oceanic crust by drilling sites in all the ocean basins where the crust and mantle are tectonically exposed at shallower depths. This theme highlights some successes that were possible through this alternative approach, showing that scientific ocean drilling provides critical insights into the differences between ocean crust formation in fast and slow seafloor spreading systems, in the volcanism that creates large oceanic plateaus or rises, with profound environmental effects, in the initiation and evolution of subduction zones and small ocean basins, and in the study of hotspot trails, such as the Hawaii-Emperor and Louisville seamount chains that form above rising mantle plumes originating at the core-mantle boundary. All of these studies are providing a window into Earth's oceanic crust and mantle not achievable by any other methods, and are allowing us to chart the very dynamic character of the deep Earth.

– Anthony A.P. Koppers