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LITHOS-iLAB – an 1100 km long seismic and heat flow transect in the equatorial Atlantic Ocean, covering 0 to 50 Ma oceanic lithosphere

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Along the global mid-ocean ridge system, new oceanic lithosphere is continuously created by seafloor spreading, which today floors approximately 60% of Earth's surface. Crustal thickness and lower crustal velocity are inherently related to the formation of the plate and can be used to infer periodicities in crustal accretion when being reveal along a flowline transect. After its formation the shallow lithosphere or crust is affected by hydrothermal circulation in the uppermost permeable crust over tens of millions of years. In turn, heat is removed from the lithosphere by circulating seawater and mineral precipitation modifies and seals open void spaces, affecting heat loss, seismic velocity, and composition of the crust. With age, lithosphere cools and thickens, resulting in the well-known subsidence of the seabed, decreasing heat flow, geoid height, and increasing seismic velocities in the uppermost mantle. Further, the depth to the Lithosphere-Asthenosphere-Boundary (LAB) increases from approximately 10 km depth to several tens of kilometres for older crust. While the formation of crust and lithosphere at spreading ridges is reasonably well studied, little is known about how crustal accretion changed over time and how crust and lithosphere change when carried away from the underlying heat source. Understanding how lithosphere evolves with age is thus a major challenge in Earth sciences. In November and December of 2017, we acquired an 1100-km-long transect in the equatorial Atlantic Ocean aboard the German research vessel MARIA S. MERIAN. The profiles runs from 12.8°W/2.8°S, for 75 km on the South American plate, crosses the Mid-Atlantic Ridge, and terminates at 3.2°W/0.7°S, covering zero-age to approximately 50 Myr old lithosphere of the African plate. The seismic refraction and wide-angle transect was covered with 71 Ocean-Bottom-Seismometers and hydrophones spaced at 10 to 20 km intervals. The profile was shot at an increased interval of 210 s to decrease the shot-induced-level, improving signal-noise-ratio and providing an average shot spacing of 410 m. In addition, 75 heat flow measurements were made along the transect, surveying heat flow as a function of plate age. We will report preliminary results from the seismic profile and provide constraints on heat loss.