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Influence and the timing of regional tectonic change on NW Australian hydroclimate and oceanography: Insights from IODP Sites U1463 and U1464

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Northwest Australia's climate and shelfal oceangraphy is tightly linked to changes in the Indonesian Throughflow (ITF). Since the Neogene the Australian continent has moved northwards and the Maritime Continent has emerged. These tectonic changes had a major impact on the Indonesian Gateway and the surrounding continents by restricting ITF flow and influencing continental hydroclimate. The regional impact of this change was established for NW Australia at IODP Site U1463 using novel proxies based on natural gamma radiation (NGR) (Christensen et al., 2017; De Vleeschouwer et al., 2017). The U1463 sedimentary record reveals that the Australian continent was wet in the Late Miocene and Pliocene until 2.4 Ma when the onset of the modern dust pathway and arid conditions established. Significant reductions in sea surface temperature (SST) support concurrent changes in the ITF at 2.4 Ma (Smith et al. 2017); however subsequent SST fluctuations suggest additional factors were involved. The NW Australian shelf was impacted by uplift between 2 and 1 Ma (Kominz et al. 2017), significantly altering the morphology and bathymetry of the NW shelf, and likely affecting SST and upwelling.

The approach of using shipboard-generated NGR-based proxies to elucidate hydroclimate and dust history appears to work well for NW Australia. However, this approach remains to be tested at additional sites. Here we broaden lithostratigraphic analyses from U1463 to nearby Site U1464, located to the NE, which was drilled in a similar oceanographic setting but at a site located more proximal to the modern dust pathway. We utilize elemental ratios from scanning XRF to confirm that NGR- derived potassium (K) and uranium (U) records indeed reflect fluctuations in continental humidity and dust, respectively. Our coupled lithostratigraphic and geochemical analyses provide further support for the use of NGR-based hydroclimate proxies. Through integrated stratigraphic investigation of these two sites we gain insights into the timing and regional extent of hydroclimate and oceanographic changes, including the onset of the modern dust pathway and ITF variability.