Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20483

Plio-Pleistocene dust fluxes to the western equatorial Pacific constrained via helium isotopes and sedimentary 10Be

JENNIFER L MIDDLETON[1] AND GISELA WINCKLER[2]

[1]Columbia University

[2]Lamont-Doherty Earth Observatory

Presenting Author: jennym@ldeo.columbia.edu

Constant flux proxies, such as extraterrestrial helium-3 ($^{3}He_{ET}$) and excess thorium-230 ($^{230}Th_{XS}$), are valuable tools for the generation of sediment accumulation rate records that are independent of biases associated with lateral sediment advection on the seafloor. Such records are critical to our ability to reconstruct sedimentary dust flux records that yield quantitative constraints on past changes in continental dust emissions, aridity, atmospheric aerosol loading and transport, and nutrient delivery to marine ecosystems. While the half-life of $^{230}Th_{XS}$ limits its analytical range to sediments younger than 500 ka, the utilization of $^{3}He_{ET}$ -normalization in older sediments has been complicated by a lack of independent constraints on potential variations in the global influx of $^{3}He_{ET}$ from space over time. Here we examine the potential for Plio-Pleistocene variation in the $^{3}He_{ET}$ influx from space using co-located measurements of helium isotopes and sedimentary ^{10}Be in samples from ODP Site 806 in the western equatorial Pacific.

We observe a 50% standard deviation in $^{3}He_{ET}$ /^{10}Be ratios around a long-term average of 3.82 pcc/(atoms*10^{8}) at this site. $^{230}Th_{XS}$ analyses in the youngest samples suggest that the observed scatter in $^{3}He_{ET}$ /^{10}Be ratios likely results from variations in ^{10}Be scavenging efficiency associated with changing sediment composition. Importantly, our paired $^{3}He_{ET}$-^{10}Be data suggest no significant trends in the $^{3}He_{ET}$ influx from space over the past 3.5 Ma. This result enables direct comparison of $^{3}He_{ET}$-normalized flux values from late Pliocene and early Pleistocene sediments to those from samples younger than 500 ka. Building on these results, we present a new $^{3}He_{ET}$-normalized ^{4}He-based dust flux record for the western equatorial Pacific spanning the past 3.5 Ma by combining our data with previous measurements in ODP Site 806 sediments. This record represents the first constant flux proxy-normalized dust flux record spanning the Plio-Pleistocene from any tropical location.