Geophysical Research Abstracts
Vol. 21, EGU2019-7023, 2019
EGU General Assembly 2019

Strength of the Indonesian throughflow heat transport during the mid-Pliocene and its effects on the marine fauna: insights from the Northern Carnarvon Basin

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A stratigraphic succession from the Northern Carnarvon Basin (Site U1463) was examined for paleoclimatological changes during the early to mid Pliocene. Carnarvon basin is one of the Australian biodiversity hotspots and is heavily influenced by the southward transfer of warm waters along western Australia via the Leeuwin Current, which is a branch of the Indonesian throughflow. It plays a significant role in regulating the nutrient distribution as well as the temperature and amount of rainfall received in the area.
Statistical analysis on benthic foraminifera revealed two distinct assemblages. Biofacies I (∼3.5 to 3.21 Ma) is dominated by Guttulina bartschi, Uvigerina proboscidea and Trifarina bradyi thriving in a high energy regime, with intermediate to high productivity levels following a re-organisation of the ecosystem. Dominance of biofacies I prior to the Marine Isotope Stage M2 event documents the influence of deep-water upwelling and a subdued influence of Leeuwin Current. A new biofacies II appears after the KM5 event (∼3.17 to 3.03 Ma) represented by Bolivina vadescens, Siphouvigerina porrecta, Bulimina aculeata, Heterolepa praecincta, and Planorbulinella larvata, indicating an ecological shift from opportunistic infaunal taxa preferring dysoxic and high productivity environments transitioning to more shallower, oxygen loving photic zone dwellers approaching 3 Ma. Epifaunal species gradually became more abundant after the M2 event, more so after the KM5 event, indicating increased ventilation and further strengthening of the Leeuwin Current.
Benthic species diversity in terms of Shannon-Wiener index ranged from 2.5 to 3.2, and species evenness ranged from 0.41 to 0.63 indicating some intervals were represented by few dominating species and thus lower diversity than other intervals. However, the diversity fluctuated in sync with the glacial-interglacial changes with low values during glacials (lowest during glacial event M2) and higher during interglacial intervals. The diversity indices were compared to two benthic species, Uvigerina proboscidea (thrives in intermediate to high productivity and low seasonality, irrespective of deep-sea oxygenation) and Siphouvigerina porrecta (thrives in sustained flux of organic matter in low-oxygen environment). Uvigerina proboscidea shows an inverse relation with species diversity indicating that benthic species diversity was low during glacial intervals with variable flux of organic matter, low seasonality and relatively higher oxygen levels and vice versa for interglacial periods.