Differences of paleoceanography between the eastern Indian Ocean and the western equatorial Pacific during the late Quaternary

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The Western Pacific Warm Pool (WPWP) has played an important role in modulating global climate, and extends from the western equatorial Pacifc to the northeastern Indian Ocean via the Indonesian Throughflow. Therefore, this area plays an important role in the ENSO and Asian monsoon. Recently, it is well recognized that Indonesian Archipelago is a key player in the global thermohaline circulation system, also called the Global Ocean Conveyor Belt, at present and during the late Quaternary, because huge area of the continental shelf was above sea level during the glacial times and it brought different environments in this area. Therefore, in order to understand the oceanographic environment of the eastern Indian Ocean influenced by the warm pool, the Indonesian Throughflow and the fluctuation of land-ocean material interaction due to river inputs and to verify the fluctuation of paleoenvironment, sedimentation of biogenic components and inorganic elements were measured in four gravity cores in this study. The cores were retrieved at Site GC5 (WPWP site; 14S, 121E, 2,472 m), GC11 (south WPWP; 17S, 115E, 2,458 m), and GC14 (transition; 20S, 113E, 997 m).

The mean C/N ratios and correlation between OC and Al contents in each core indicate that terrigenous OC has been minor contribution to OC in the sediments, which means MAR of OC would be a proxy for primary productivity. MAR of OC in core GC5 shows high values with maxima during OIS 1/2 boundary, the middle of OIS 3, OIS 4, and the middle of OIS 5, which implies that GC5 has been influenced by the Indonesian Throughflow. On the other hand, MAR of OC in the other cores remained low, suggesting that these have been under influence of oligotrophic condition.

MAR of Al in core GC5 has high values in the middle of OIS 3 and the middle of OIS 5. As Site GC5 is located in the Timor Passage, the main outlet of Indonesian Throughflow, and a reduced eolian dust input because of high precipitation, terrigenous components should be transported mainly by rivers and ocean currents. These patterns suggest higher nutrient injection caused by the enhanced Indonesian Throughflow and/or the westward flowing South Java Current. On the other hand, MAR of Al in cores GC11 and GC14 shows a broad minimum during OIS 2, 3 and 4 and a small minimum during late OIS 2 although other OISs show no clear trend. These minima would have been caused by depleted river inputs during drier times.

Since both GC5 and C4402 (2N, 135E, 4,402 m water depth) are located in the warm pool, the contents and MAR of biogenic and lithogenics are compared in order to evaluate the similarity and difference in the environments in the warm pool between the western equatorial Pacific and the northeastern equatorial Indian Ocean. The primary productivity increased during OIS 2, 3, late 6, 6/7 boundary and 8. Mass accumulation of lithogenics generally occurred during relatively low sea level periods. In contrast, GC5 showed different profiles of primary productiveity and MAR of Al. A large difference exists in these ocean environments. The drying-up and exposure of the large areas of continental platform and a definite reduction in precipitation by 30-40% over the Indonesian Archipelago and Western Australia might affect the ocean environments around GC5 significantly. Although both core sites are under influence of the Asian monsoon, Site GC5 (Indian side) might have experienced more of continental environmental change, while Site C4402 (Pacific side) remained under oceanic condition, because it is located about several hundreds of kilometers from the nearest landmass, New Guinea.