The reconstruction of the Pleistocene-Holocene turbidite sand delivery in Gulf of Papua aided by SEM-MLA provenance analysis

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An integrated provenance, textural and chronostratigraphic analysis of Pleistocene-Holocene turbidite sand in the Gulf of Papua (NSF Source to Sink Focus Area) has been undertaken to elucidate glacioeustatic influences on sedimentary behaviour in a modern deepwater depositional system. Sands were sampled in seven jumbo piston cores from the slope and basin floor, yielding 53 samples. A quantitative modal mineralogy analysis was conducted using scanning electron microscopy (SEM) and mineral liberation analysis (MLA) of ~15,000 individual grains per sample. Tests using the Gazzi-Dickinson ternary diagram show a lack of differentiation among samples. Although free from grain-size effects, use of this diagram is strongly affected by the detailed mineralogical classification that results from automated MLA. MLA does allow sample differentiation using heavy minerals sensitive ratio and multivariate analysis such as non metric multidimensional scaling (nMDS) and principal component analysis (PCA).

Time-sliced provenance based on our C-14 age model shows three major pathways: (1) long-distance northwest-southeast sediment transport of quartzofeldspathic sand sourced from the Papuan Mainland, delivered from the Fly-Strickland fluvial system through Pandora shelf and slope (core MV-54), Pandora basin floor (cores MV-23, 33) and Moresby Channel (MV-25, 29), characterized by low m/f and pumice content and decreasing of l/h-hm and unstable/tourmaline (uti) ratio basinward; (2) short-distance NNE-SSW transport of felsic-mafic volcanic sand apparently from the collision margin of the Papuan Peninsula, delivered via small rivers narrow shelf, and deep-sea canyons (MV-22) characterized by high m/f ratio without distinct pattern of heavy minerals ratio and (3) intermediate-distance delivery from the Fly-Strickland and Papuan Peninsula along coastal pathways to the Moresby Trough (MV-22) characterized by high pumice contents, overall low in uti and l/h-hm. The vertical provenance pattern shows that the Pandora Trough samples (MV 23, 33, 54) were entirely pathway 1 during the time period 44–17 Ka, while Moresby Trough received sediment via pathway 1 (MV-25, 29) and pathway 2 (MV-22), gradually shifting to pathway 3 from late Pleistocene to the middle Holocene. We also suggest that the Gazzi Dickinson scheme be re-evaluated in light of powerful new auto-

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mated MLA techniques, to allow better sample discrimination in fine-grained lithic and felsic sands typical of our study area, and many other deep-water basins.