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Facies Analysis and Population Structure of Fossiliferous Ediacaran Deposits in Southern Namibia

Katie Maloney (1), Amanda Facciol (1), Brandt Gibson (2), Alison Cribb (2), Bryce Koester (2), Charlotte Kenchington (3), Thoma Boag (4), Rachel Racicot (2), Simon Darroch (2), and Marc Laflamme (1)

(1) University of Toronto, Toronto, Canada (katie.maloney@mail.utoronto.ca), (2) Vanderbilt University, Nashville, USA, (3) Memorial University of Newfoundland, St. John's, Canada, (4) Stanford University, Stanford, USA

The latest Neoproterozoic (Ediacaran: 635–541 Ma) is a crucial period of Earth history because of the emergence the first known, large complex, multicellular organisms commonly referred to as the Ediacara Biota. These organisms are diverse and have a worldwide distribution with the some of the youngest of the Ediacara Biota found in southern Namibia, close to the Ediacaran-Cambrian boundary. Ediacaran fossils in the Nama Group were deposited in a foreland basin associated with the Damara Orogen during the assembly of Gondwana (580 to 680 Ma). The Kuibis Subgroup in the southern subbasin is significant because it hosts an abundance of Ernietta, a classic Ediacaran fossil that has received a considerable amount of study in recent years. Detailed sedimentary analyses utilizing facies-based approaches can provide valuable insight into the paleoecology of the Ediacara Biota. The distribution of facies at a known Ediacaran fossil site, the Kuibis Subgroup exposed Farm Hansburg was investigated by conducting a facies analysis based on 16 measured sections. Lithologic samples were collected at 4 sites and used to provide evidence of the differences in macrosedimentologic structures between the fossil rich layers and other sandstone beds. The 8 identified facies and 3 facies associations were then used to interpret the paleoenvironment as a tide-influenced fluvial to marine transgression with an abundance of microbial mats and identify limiting factors that could have impacted the Ernietta. A collection of more than 240 Ernietta were recovered from Farm Hansburg, photographed, and their morphology quantified. The resulting database was analyzed through the package MCLUST in R to investigate the reproduction, feeding strategy, and growth of Ernietta based on their response to limiting factors in the environment. Ernietta were found in the storm influenced muddy tidal flat paleoenvironment (FA2) indicating these organisms thrived in environments with periodic clastic sediment supply, fluctuating salinity, and medium to high flow velocity. This facies analysis also aids in constraining the chemical and physical characteristics of each paleoenvironment, which would have impacted the Ernietta and influenced population dynamics. Most Ernietta populations were unimodal suggesting continuous reproduction, except for two sites (HB1B & HB1C) that are associated with F3, indicating a higher energy environment with potentially more variability. The emphasis on integrating both sedimentary and paleontological data into a single study of Ediacaran population dynamics will provide valuable insight into ecosystem development at the base of the metazoan tree.