

HOW LIFE MAY HAVE WORKED – MUSINGS AND TECHNIQUES FOR BRINGING FOSSILS BACK TO LIFE! ..1. *RANGEA* 2. *DIPROTODON*

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The Ediacaran frond *Rangea* was the first large and complex Precambrian fossil named and described anywhere in the world, and to this day is an iconic image of the Ediacaran biota. *Rangea* is also the type genus of the Rangeomorpha, an extinct clade that lies near the base of the evolutionary tree of large, complex organisms which radiated broadly during the late Neoproterozoic, and then disappeared abruptly, with the rise of organisms boasting hard shells. *Rangea* is a centimetre- to decimetre-scale frond consisting of several vanes that radiate from an axis, with each vane consisting of a sheet of elements composed of a repetitive pattern of self-similar branches. In the century since its discovery in 1908, *Rangea* material has remained rare, but a new site discovered in 2004 yielded more than 100 specimens boasting both 3 dimensions and high quality preservation. These new specimens thus increased the *Rangea* dataset by a factor of five and exhibited a unique style of preservation that has permitted some investigative preparation, revealing previously unknown internal features, including a true six-fold symmetry and thus significantly enhanced understanding of *Rangea* and its place in the early evolution of complex macroscopic life.

The new *Rangea* fossils were recovered from the Nama Group on Farm Aar in southern Namibia by a team that was part of the International Geosciences Program project IGCP493/587. The Nama sediments are a 3-km thick succession of generally flat-lying, fine-grained siliciclastic and carbonaceous strata that non-conformably overlie Mesoproterozoic basement, deposited in a foreland basin resulting from the collision of the Damara and Gariiep structural belts in the late Ediacaran and early Cambrian. The new specimens discovered were recovered from the now newly named Aar Member of the Dabis Formation, Kuibis Subgroup, in the Nama Group. The productive sediments are part of a muddy mid-ramp assemblage deposited just below normal wave-base, in an environment characterized by gentle wave and current action and periodically disturbed by major storms, probably within the photic zone. The majority of specimens recovered were in gutters within this muddy sequence and due to their exquisite preservation had likely not moved far from where they lived. Each gutter exhibits a bipartite fill similar to that of the storm event beds in the section. The lower half is made up of unfossiliferous, finely laminated, fine-grained quartz sandstone, totally confined to the gutter cast. This is abruptly overlain by very fine-grained quartz sandstone with low angle hummocks and swales that fills the gutter casts and occasionally steps beyond the erosional margins of the underlying channel.

Based on the new specimens of *Rangea* recovered from Farm Aar, *Rangea* appears to have been an epibenthic, unteathered frond that was stabilized by partial sand fill during life of its central axial region. This internal fill is lithologically dissimilar to the very fine-grained sandstone that has entombed the fossils, but is compositional, texturally and diagenetically similar to the fine-grained sandstone layer which forms the basal fill of the gutter cast below the fossils. This axial fill becomes increasingly loosely packed and porous along the stalk towards the distal end, which is usually preserved as an open void.

The very three dimensional nature of the new material along with part of the inside exposed of these enigmatic life forms gives an opportunity for further exploratory scanning and study of these successful first large, complex organisms as well as the possibility of production of replicas that can be shared with collections globally.